

Turbo Basic

Introducing Turbo Basic, the highspeed BASIC you'd expect from

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It's the BASIC compiler you've been waiting for. And it's so fast that you'll never have to wait

again. Turbo Basic is a complete development environment; it includes a lightning-fast compiler, an interactive editor, and a trace debug-

ging system.

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You probably already know us for both Turbo Pascal* and Turbo Prolog.* Well, we've done it again! We created Turbo Basic, because BASIC doesn't have to be

slow.
In fact, building fast compilers is a Borland specialty; both our Turbo Pascal and our Turbo Prolog outperform all their ivals by factors, and with Turbo Basic, we're proud to introduce the first high-speed BASIC compiler for the IBM*PC. If BASIC Budght you how to walf, Turbo Basic will teach you how to man!

The Critics' Choice 66 Borland has succeeded in

• Botand has succeeded in stretching the language without weighing us down with unnecestary details. Turbo Basic is the answer to my wish for a simple yet bilindingly fast recreational utility language. The one language you can't forget how to use. Turbo Basic is a computer language for the missus, the masters, the masses, and masses, and masses.

Borland's Turbo Basic has advantages over the Microsoft product, including support of the highspeed 8087 math chip.

John C. Dvorak 9 9

Turbo Basic ends the basic confusion

There's now one standard: Turbo Basic.

It's fast, BASICA-compatible, and because Turbo Basic is a Borland product, the price is right, the quality is there, and the power is at your fingertips. You see, Turbo Basic's part of the fast-growing Borland family of programming languages-we call it the "Turbo Family." Hundreds of thousands of users are already using Borland's languages, so you can't go wrong. So join a whole new generation of smart IBM PC users-get your copy of Turbo Basic today. You get an easy-to-read 300+ page manual, two disks, and a free MicroCalc spreadsheet—and an instant start in the fast new world of Turbo Basic. All of this for only \$99.95--Order your copy of Turbo Basic today!

Free spreadsheet included, complete with source code!

Yes, we've included MicroCalc, our sample spreadsheet, complete with source code, so that you can get started right away with a "real program." You can compile and run it "as is," or modify it

A technical look at Turbo Basic

- ✓ Full recursion supported

 ✓ Standard IEEE floating-point
- ✓ Floating-point support, with full 8087 (math co-processor) integration. Software emulation if no. 8097 present
- ✓ Program size limited only by available memory (no 64K limitation)
- ☑ EGA and CGA support
- Access to local, static, and global
- Full integration of the compiler, editor, and executable program, with separate windows for editing, messages, tracing, and execution
- Compile, run-time, and I/O errors place you in the source code where error occurred
- where error occurred

 ✓ New long integer (32-bit) data
- type

 Full 80-bit precision
- ✓ Pull-down menus
 ✓ Full window management

System requirements
IBM PC, XT, AT and true compatibles, PC-DOS (MS-DOS) 20 or later. One floopy drive, 256K.



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Mouse, just find it on the on-screen menu and click. Not having to enter a handful of keystrokes means you can work much faster.

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And when you're finished, you can use an Expert Mouse Menu to back up a Display-Write 3 document with just two clicks. Or use our mouse to load MultiMate* documents without ever having to type out a file name again.

This mouse knows its 1-2-3's.

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THANKS FOR THE MEMORIES

Have you ever noticed how time seems to change everything? Fashions change. Technology changes. Even the microcomputers we use change. Maybe that's why so many of our customers are saying goodbye to 1BM in favor of a "good buy" from Wells American.

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COVER STORY

Security Strategies:
Hardware Protection for PCs
Richard Aarons and Robin
Raskin Protection for PCs and
the data they contain is always
high priority but not
socitisately high-tech or
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SPECIAL REPORT Laser Printer Technology Great Performance for Under \$3,000

United Schools, Bill Mandelvers, Alfred Poor, and Jim SymourFor a long time. Hewlett-Packard's Lascript was the unchallenged champion in the baser printer arena. Now. new low-cost lasser printers like Epson's SQC 500, Okidata's Lascriptine 6, OMS's Big Kiss, and Ricch's PC Laser 6000 are ready to take contender, the Lascript Series II. Is the Series II equal to the battle ahead?.

 Sheet Feeders Multiply Your Printing Options
 Phil Wiswell Multiple-bin
 sheet feeders can make your HP
 do new tricks. BDT's MF 850
 and MF 830 Laser Feeders.
 Hewlett-Packard's Laserjet
 500 Ptus, and Ziyad's Paperlet
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and print envelopes in the same

job, saving you both time and

• Pluses for Your HP Laserjet

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Bill O Brien/The popularity of
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COMPUTERS 10-MHz Computers; High

Speed, Low Risk
Winn L. Roschi'How fast is fast
enough? These six computers,
from AST, Computer Direct,
Kaypro, Proteus Technology,
PC's Limited, and Multites,
aren't as fast as their 12-MHz
counterparts, but they boast
full and unconditional



SOFTWARE Better Tools for Backup

Winn L. Rosschiff you want to save your hand disk's data in a safe place but don't want to buy an expensive tape backup system or spend hours copying files, try one of these programs. Products reviewed include Pdisk. Corefast, Intelligent Backup, Backup Master, Fastback, and DSBackup Plus. 263

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Cover Photograph: Roberto Brosan

WHAT'S INSIDE



The quiet whoosh of laser printers makes the office a gentler place than in the rata-ata-tat heyday of Spinwriters and Diablo printers. Lasers outperform daisy wheels as much as tenfold (8 laser-printed pages per milute is equal to 250 to 500 characters per second), and that's about how far lasers outrank

daisy wheels on the complexity scale, too. With a daisy wheel, you had but two concerns: which printwheel to use and fabric versus multistrike ribbon. (Actually, three, if you count the fear of strangulation should you lean over and catch your tie.)

With learn or grinters: the basileting arms of fear or

With laser printers, there's a bewildering array of font catridges (at a breathtaking \$2000 to \$300 a pop, again holding to the rough 10:1 ratio over daisy wheels), literally hundreds of downloadable fonts, memory boards, font programs masquerading as desktop publishers, and concerns over whether to share the printer over several users and how to print envelopes.

The driving force behind the laser revolution is flexibility (you can mix text and graphics), slience, speed, and bang for the buck. In this issue, PC Magazine looks at five new laser printers under \$3,000. Four of them, including HP's revolutionary new Laserjet Series II, are under \$2,500, and that's what a top-of-the-line 55-cns NEC Sonitwire roots 5 vesar as oo.

To help you make sense of the liser printer market, we also look at add-ons that enhance flexibility. Bill O'fhein, one of the project leaders in PC Labs and an unrepentant laser junkle, surveys the bevy of downloadable forms and text formatters for the Laesrjet and compatibles. Contributing editor Wim L. Room reviews nine printered-shring devices that content multiple users to one laser matter heart of the contribution of

In our cover story, Robin Raskin, contributing editor Richard Aarons, and several other regulars look at the hardware side of PC security, from physical locks to keep your investments on your desks to encryption devices to protect the data.

Connectivity expert Frank J. Derfler, Jr., takes a break of sorts in our yearlong survey of LANs and recaps the 13 networks reviewed so far.

Finally, contributing editor Rosch, who found 12-MHz AT compatibles too flaky to unconditionally recommend last issue, examines five 10-MHz machines this issue and finds several reliable speedsters from famous-name makers.

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- ne Monitor with Tilk and Swivel Base
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... Ta sum up inv feelings about this mause and menu generating system: this is the ane I want" Phil Wiswell PC Magazine, Jan 27, 1987

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LETTERS TO PC MAGAZINE



OUICKBASIC QUALM

I would like to make an addition to Ethan Winer's "Wish List for QuickBASIC 3" (sidebar to PC Lab Notes, Volume 6 Number 1)-8087 support. I do not understand how a language whose very name implies that everything possible was done to make it fast can fail to provide 8087 support. Although QuickBASIC has many good features, I will remain a True BASIC user (at least until I have the chance to try Borland's Turbo BASIC).

George E. Birch Rockville, Maryland

Ethan Winer replies: I agree. With so much else going for it, it's a shame that Microsoft decided not to provide access to the 8087/80287 numeric coprocessor. One of the difficulties in supporting the device is the fact that QuickBASIC uses a nonstandard method of storing floating-point numbers internally. Borland wisely chose to use the IEEE format for Turbo BASIC, thereby eliminating that obstacle. In an informal test, I had both compilers compute the arc tangent of a double precision number 1,000 times. Turbo creamed QuickBASIC, coming in at 0.49 seconds versus a leisurely 9.1 for QuickBASIC 2.0.

OUICKBASIC OUITE PLEASING As someone who has taken IBM's BA-

SICA about as far as it can go, I really appreciated the article on Microsoft's Quick-BASIC 2.0 by Ethan Winer (PC Lab Notes, PC Magazine, Volume 6 Number 1). I was interested in finding a more powerful BASIC and had seen ads in your magazine for QuickBASIC, Better Basic, and True Basic, but never knew what they did in comparison with just plain BASIC.

At least as far as OuickBASIC is concerned, I now feel I have been given an excellent preview by Mr. Winer. In fact, I was so impressed with the article. I have decided not to hold off until I can figure out the pros and cons of Better Basic to order OuickBASIC.

Donald T. Houghtby Birmingham, Missouri

SCANNER FEATURES CLARIFIED

Thank you for your excellent review on scanners, "Page-to-Disk Technology: Nine State-of-the Art Scanners" (PC Magazine, Volume 5 Number 16). While



the background on and analysis of the various products were well designed and prepared, there were some inaccuracies regarding our Microtek MS 300A Intelligent Image Scanner that should be clarified:

The price of the MS 300A, which includes scanner hardware, image-processing software, and an interface kit, is \$2,495. The MS 300A's text-scanning output includes ASCII text files in addition to the ones that can be used directly by WordStar, WordPerfect, WordStar 2000. MultiMate, DisplayWrite, Symphony, PFS:Write, and PC Write. The graphics scanning resolution offers the widest range of resolutions of any scanner tested, with a total of 16 resolutions, from 300 dpi to 75

dpi (in 5 percent decrements). Our halftoning logic provides 12-halftone cell-resolution/texture selections and up to 52 gray levels for outstanding halftone renderings. The graphics output includes raw bitmapped, CCITT Group III compressed, TIFF, PC Paint, PC Paintbrush, GEM

Paint, and MacPaint formats. In addition to these omissions, the review also implied that one must physically remove the paper-feed rollers to clear a paper jam. In fact, opening the output door releases the pressure on the rollers much like the release on a typewriter.

Finally, while the MS 300A is currently distributed through several hundred retail dealers and VARs, all requests for information should be forwarded to our National Sales Offices: 16901 S. Western Ave., Gardena, CA 90247; (213) 321-2121.

> Robert Hsieh Vice President Microtek Labs Gardena, California

Authors Diane Burns and S. Venit reply: At the time we prepared our review, the price of OCR Systems' optical character recognition software had not yet been determined: therefore, we did not include it in the article.

We reported on the optical character recognition software as it performed at the time of our review. In the features table, our list of word processing formats supported is accurate; further, we qualified the list with "any word processor that does not override the keyboard."

We did speak with technicians at Microtek regarding the file formats graphic scans could be saved in, and we understand the conversion to PC Paintbrush to be the only translation available at the

Boost cursor speed. Stop cursor

With all the recent hoopia over performance, it's ironic that two of the PC's ergonomic deficiencies have been overlooked — its slow cursor, and the tendency of the cursor to emain in motion (run-on) after a cursor key as been released. Finally, the solution — Cruise Control™ from Revolution Software. Cruise Control is a new productivity tool for serious PC users. It buosts cursor speed, typically by 3-3X. It eliminates annoying cursor run-on. And it adds hunds-free

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■ LETTERS

time. Perhaps the company should make available to the public a timetable of the various translations that have become possible in the last few months.

Since we have completed the review, we have seen that a paper jam is indeed easy to correct. However, the manual for the scanner fails to mention the technique used to clear the jam.

PC Magazine acknowledges a production error stating the resolution of the Microtek 300A to be 200 dpi.

THE PERFECT LAPTOP

Of course there is no perfect laptop! Stewart Alsop is at least right to that extent ("The Perfect Laptop," Stewart Alsop, PC Magazine, Volume 6 Number 2). However, the laptop he proposes as ideal is certainly not the one that many of us are looking for. As a traveling columnist who writes with a Tandy Model 100 in his lap while flying in an airplane, Mr. Alsop is obviously looking for a specific type of computer of relatively limited function-a temporary extension of his desktop system. I, on the other hand, need a computer that will permit me to write in hotel rooms and borrowed offices with the ease and flexibility I enjoy in my office at home. Hugh Bayless

Carmel, California

Stewart Alsop replies: Mr. Bayless is quite right. As with desktop systems, no one laptop computer could suit the needs of all users. The point I wanted to make, though, was that there are different kinds of users and that the computer manufacturers' current rush to put the be-all desktop computer inside a laptop package is going overboard. Why doesn't a PC manufacturer start designing different kinds of laptops for different kinds of users-without sacrificing the power all laptops should have?

Stewart Alsop speaks good sense ("The Perfect Laptop")! The company that can meet his specifications will have my business. I hope someone is listening out there. Charles W. Fowlkes

Stewart Alsop's column ("The Perfect | Author M. David Stone acknowledges that Laptop") should be read by future laptop | the upgradability of the modem to 2,400

designers. It's hard to believe there are too few potential customers to make producing his kind of laptop profitable William T. Hamrick

Ider, Alabama

ZOOM/MODEM SPEAKS OUT The article "Beyond the Haves Standard"

(PC Magazine, Volume 5 Number 20) contains errors, omits important information, and evidences an oversimplistic understanding of the

ZOOM/Modern PC 1200. It implies that a hardware product is of little use unless the package also provides software to exploit the hardware capabilities fully.



The article omits a number of important features: The ZOOM/Modem PC 1200 is upgradable to 2.400 bits per second, the clock/calendar will time-and-date-stamp messages left in the RAM buffer, and the RAM buffer is upgradable to 32K bytes

Also, the author failed to mention that jumper block J5, which allows the modem

Why doesn't a PC

manufacturer start designing different kinds

of laptops without sacrificing the power all laptops should have?

to be configured for either A/A1 operation or for balanced auxiliary phone disconnect operation, is discussed in the manual on page 117. And the author erred in referring to the 400-Hz tone as a 400-MHz tone. Terry Manning

ZOOM Telephonics Boston, Massachusetts

Bozeman, Montana

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Journal of Financial Accounting, 1985

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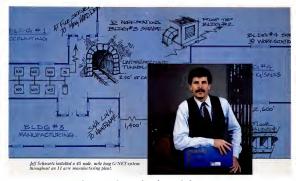
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PC Magazine March 10, 1987





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LETTERS

hps and of its RAM buffer to 32K, as well as at the time-and-date-stamping features, would have been worth noting had the manual mentioned these; it did not. Moreover, jumper block 15 is mentioned neither on page 17 the glossary ion in the section where jumpers are discussed. According to page 16, the AAI configuration is handled by jumper block 13, and no mention is made of time in Same 10 to 10 to

As for the modern itself, Mr. Stone replies: "My concluding purgraphy reads: "To truly take advantage of the ZOOMModern PCC extra features, sold I have to write your own communication programs or a scripts. If you are lost of ing that sort of thing, you'll have a lost of fam with the ZOOMModern Others, you you probably won't be able to take advanage of all its extra features: Earth features that the product, this statement, and standard products who will be able to make

use of the extra features and who won't."

PC Magazine acknowledges a printed error: 400 MHz should have been 400 Hz.

OVERTYPE MODE PREFERRED

Thank you for the recent First Looks review of our Electric Pencil PC (First Looks, page 38, PC Magazine, Volume 6 Number 2). While I agree with most of Christopher Johnston's comments, I would like to take issue with the objection he had with Electric Pencil PC running in the overtyee mode.

Many of the popular word processors default to the overtype mode and toggle in and out of the insert mode. Based on present user input, we sincerely feel that running in the overtype mode and toggling to the insert mode when required satisfies the majority of users.

Stan Feldman President Electric Software Corp. Dallas, Texas

CORRECTIONS/AMPLIFICATIONS

In the article "Asynchronous Communications: Shopping for Software" (PC Magazine, Volume 5 Number 18), there were several errors in the Summary of Features table concerning the Mycroft Labs' Mite Iline of software. MaxiMite, Maxi-Mite Plus, and DynaMite do support man-



ual dial, fully automated auto-dial/autolog-on, half duplex, all protocols in remote mode, up to 15 repeat dials, and up to 38,400 bits per second. In addition, the three products do exit to DOS without dropping a carrier.

MaxiMite does include ANSI COLOR emulation and is available for CP/M-80. DynaMite supports a script language (Morse) and VT52 and does not have a learn feature.

Brown Bag Software no longer copy protects its software. Its products are



shareware, not public domain ("Abort, Retry, Ignore?," PC Magazine, Volume 6 Number 1).

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A source-level debugger that puts the rest anachment of field-specific help messages

and functions you ware called to devolve messages or validate entries. And you cade which keys will clear a field, jump to the next or prox, quit, etc. Options diverse enough that a set of "fields" can be made to behave life a Lorus" menu Specify Compiler Lest PC Brand. 70100 Wandows for C 70150 Windows for Data *295

MICROSOFT C 4.0 A Great C Battle Rages and You're Winning

s the dreadnaughts pound each A sithe diseach aughts pound even other with ever heavier ordnance today's programmers reap the spors of this war Bundling a source debugger and a 'make', and sporting a "tuge" memory model permitting single data objects larger than 64k, the Microsoft C compiles has jumped a full version number to 40 Rie whare really impressive are the bench But what's reasy impressive are the or marks reported in Dr. Dobb's (8/86) encyclopiedic survey of 17 C compiler Microsoft's and IBM's C (scenaed from Microsoft) run away with the contest winning II of 27 benchmarks.
The Codel/sew™ debugger, free for a irrated time, uses windows to show everything on one screen source alongside

Microsoft C now has five memory mod for code and data, plus non-library support for another thateen, and boasts alternate math packages for speed versus accuracy, with or without 8087/80287 chips. Both linker and library manager are part of the package, as is the "make" name for a smart batch program which knows to expend minimum effort to rebuild any size of project by compuling and assembling only elements affected by new or changed modules It is reportedly used by Lotus, Ashton Tate and, fittingly, Microsoft iself to develop Windows, Dobb's calls in "the best MS-DOS

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> F. Louis Floyd Strongsville, Ohio

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Iberville, Louisiana

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Bill Madler

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FIRST LOOKS

Intel's Inboard 386 Blazes An Upgrade Path for ATs

HANDS ON BY WINN L. ROSCH

It a engine that runs the personal computer industry is regrets. Buy one computer and 6 months later, you regret not waiting just a little while longer to get the latest technology. Everyone who bought an 80286-based AT or compatible learned this lesson when the 80386 micro-

processor became the latest

Intel Corp. 's Inboard 386/AT is the latest regret remover. Pop in this expansion board, and your AT becomes an 80386-based powerhouse. Your remorse should go into remission.

One megabyte of memory (in the form of 36 paritychecked, 120-nanosecond, 256K-bit dynamic RAM chips) and a high-speed cache on the

Inboard 386/AT give it full 32bit operation at its microprocessor's top-rated speed of 16 MHz. At best, that's enough to double the processing performance of an AT, challenging Compaq's state-of-the-art

Achieving that end means backfilling the AT's DOS-addressable memory, except for the first 256K bytes, using half a megabyte of the Inboard's fast

RAM, to take advantage of the Inboard's faster clock speed. The AT's bus still operates at 8 MHz; 6-MHz ATs must be speeded up to 8 MHz, and Intel provides a faster crystal to do just that. The rest of the Inboard's bytes can be used as extended or EMS expanded memory, using a software driver supplied by Intel.

An additional 2 megabytes

WordStar 4.0: Face-lift Adds Speed, Keeps Logic Structure

HANDS ON BY MARTIN PORTER

WordStar Professional, Release 4.0, is like an aging actress who refuses to leave the stage long past her prime. The faded actress has had a face-lift and has trod the boards long enough to know how to remain

Those who loved her when she was young will find that this latest upgrade, WordStar Professional, Release 4.0, is even more of a beauty now. Many of the inherent problems that have irritated users for so long have finally been solved, and occasionally a thoughtful perquisite has been added.

But let the innocent be fore warned: the faded star has a style from another era. Her and even some newly coined

Among its new features, WordStar 4.0 displays p

tion you can draw boxes around text

famed clandestine command | International Corp.'s credo: logic remains as haffling as ever | confuse them into oblivion Still, here is what the re-

Deskpro 386.

C:PC_M/C	M1 L33 C12	Insert Align	Column H E H I
1501	H + 190		OTHER
moderine autocript		1 phanton phanton	t char binding space t line print posse space column tab rabout 9 fixed position
_		QUE custon	
s is an example	s of normal text		
s text is unde s text is cross			
n text in hold n text in make			
s text is some			

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HALD DEF A page designer36 MIX C WORKS Good for beginners......36 **BOOKMARK** Keeps tabs on RAM 38 PRINCETON LS300 Smooth scanning 38 OUICK LOOKS......43 PC TYPE WRITE Proofreads everything as you TURBOFONTS Displays and prints over 1.000 foreign characters .. 46 19-INCH FGA MONITORS

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From Aydin Controls and

Epsilon Graphics 48

WordStar

(continued from page 33) vamped WordStar allows you to do now: You can edit or store a file in any directory (or subdirectory) simply by identifying its directory path. You are able to salvage obliterated type with an unerase function key (the solution to Ctrl-T and Ctrl-Y mixups). The function keys are easily customized for up to 40 different strings of commands

(or text) The program now supports proportional spacing. It lets you skip to any page or line in the document and it lets you perform 14 built-in math functions

straight from the text. More: It lets you draw boxes and lines around your copy. Underline and boldface are displayed on-screen. The remaining disk space and file sizes are furnished at the main directory. Add the furnished spelling checker and thesaurus that come along for the ride and its main menu indexing and table-ofcontents features, and it becomes a pretty damn complete word processor

It also runs faster. Bravo. So why am I not so in love with it? The programmers assumed they had to dress Word-Star up-besides adding the new features-in order to compete with newer, more-accessible programs. The makeup

doesn't make anything easier; it just makes it look unfamiliar and new. Besides, the new main menu isn't any easier to read now that they eliminated the section headings

The stacked function key descriptions are an eyesore at the bottom of the screen. And I'm still not used to working with the keyboard overlay needed to memorize my 40 new function keys; hasn't MicroPro heard of pull-down menus?

Oddly, the programmers

added keystrokes to some older commands: Ctrl-O-S-2 for double space has become Ctrl-O-S-2-Return

A cursor move won't satisfy many of the program's Y/N security clearances. And Micro-Pro made the Delete key work like Ctrl-G so that it rubs out the character at the cursor. I'm so accustomed to the Delete key's backspace/rub out by now that I'm now making more erase mistakes than before. But just when I was getting

fed up with Release 4.0's unnecessary jive and just when I started to wonder why (after 8 years) MicroPro still hasn't got anything exactly right, I found some new hidden powers in the program-the clearly defined block marked text and the multiple printout option-and I ex-

claimed, "Hey, Release 4.0's worth the switch." First-time users will probably not be as impressed.



WordStar Professional, Release 4.0 MicroPro International Corp 33 San Pabto Ave San Rafael, CA 94903 (415) 499-7676 List Price: \$495; \$595 for LAN

version: upgrade for registered mers \$80 Requires: 128K RAM, DOS In Short: All the commands WordStar users have been clamoring for. The screen design is more confusing than before, and the program is as difficult to

learn as ever. Stitt. for Word-Stor hard cores it is a cost-effective and well-advised upgrade. Not copy protected. CIRCLE 444 ON READER SERVICE CARD

Inboard 386/AT

ntinued from page 33) of fast RAM can be installed on an ontional Inboard daughtercard. If you need more speed, the Inboard 386/AT has space for an 80387 numeric coprocessor-or, until the new chips become readily available later this year, a small adapter board equipped with a 10-MHz 80287. Intel recommends that



The Inboard has two sockets. One, in the center, connects to a cable leading to the AT's 286; the socket on the right plugs into an optional module for a 287 coprocessor.

you have a dealer install your I Inboard.

To install the Inboard

386/AT, you'll first have to pull the 80286 microprocessor out of your AT (and the 80287, if your

Reletive Times

100

system is equipped with one), using a special tool supplied by Intel, and then plug a connector cable into the vacant socket. You may have to pull out your disk drive, unplug disk drives from the controller, and rearrange boards to provide sufficient access. Replace the crystal if the machine is a 6-MHz AT. Finally, plug the other end of

the cable into the Inboard



Benchmark Tests: Intel Inboard 386/AT vs. 6-MHz IBM PC AT and Compag Deskpro 386

its for the Intel Inboard 386 AT were obtained in a 6-MHz IBM PC AT with the Inboard's RAM replacing all but the lower 256K in the AT. The hard disk tests essentially show that the Inboard posts no I/O penalty and that hard disk access is not significantly affected by the Inboard's

Performance Times (Times given in seconds except where noted)

Product	NOP	Instruction Mix	Seek (milliseconds)
IBM PC AT (6 MHz)	5.7	12.6	39.1
Compaq Deskpro 386	3.0	5.2	27.5
Intel Inboard 386/AT	2.7	46	36.2

The NOP benchmark test is designed to measure raw lock speed and memory access time while minimizing differences in microprocessors and the effect of memory caching. This test executes almost nothing but NOP ("No Operation") machine code instructions in a big 128K loop.

time a taken to execute a selected series of processor intensive tasks. The test program uses 8086 instruction code. These instructions are a subset of the total process.

it takes to do a random seek using the disk's ROM BIOS The test result includes minimal software overhead and may not parallel the manufacturer's claimed average access time. The test program performs 1,000 seeks average result is shown in miliseconds

StarFixer Makes WordStar Manageable

HANDS ON

BY MARTIN PORTER

You've heard for years how easy it is to customize Word-Star. It takes only an AU-TOEXEC command here, a BASIC patch there. Or you somehow locate a pamphlet called UnderGround WordStor and make all your changes from the classic itself.

Relatively speaking, it's all a pain.

However, a new do-it-yourself fix-it program called Star-Fixer (from Hard/Soft Press and sold by Bantam Electronic Publishing in retail stores) puts new life in any 3.24 through 3.x WordStar disk and provides longtime users with instant fixes for which they've long been hunting. StorFixer addresses foibles with simple and relative-

ly elegant solutions The package itself includes a 276-page manual-probably the most-comprehensive disStar fixes and user advice since the publication of Under-Ground WordStar itself. Not surprisingly, StorFixer's authors are PC Mogozine editors



StarFixet lets you add ten extra function keys to WordStar-and makes it a breeze to

386/AT, then slide the board into a 16-bit expansion slot, and you're done. Intel was very stingy on the length of this \$200 cable: maneuvering it around other boards is a chore.

Because the Inboard is full AT height, it can't be squeezed into the PC-XT Model 286. The Compaq and Tandy 3000 AT compatibles (which use a differently packaged 80286 chip) are also expressly supported by Intel but require the use of a different connector cable. All cables are ordered and supplied separately from the Inboard 386/AT. Because current DOS applications are limited to 16-bit operation, the Inboard 386/AT cannot reach its full 32-bit speed potential running today's software.

customize these new keys as well as the existing ones.

As any computer salesperson will tell you, the use you get from a computer in the few hours between the time you buy it and the time it becomes obsolete should more than offset any regrets you have. After adding the Inboard 386/AT to your AT compatible, however, you won't even have reason to regret-perhaps until there's an

80486

Inboard 386/AT Intel Corp. Personal Computer Enhancement Operation 5200 NE Elam Young Pkwv. Hillsboro, OR 97124 (503) 629-7354 List Price: With 0K RAM. \$1.795: 1 Mhyte RAM, \$2.295: 286/386 cable, \$200; ptggyback memory card with I Mbyte RAM, \$645; piggyback memo-

ry card with 2 Mbytes RAM. \$1,145; 10-MHz 80287 math coprocessor module, \$495. Requires: IBM, Tandy, or Compaq AT. In Short: An 80386-based turbo board that replaces an AT's 80286 to roughly double performance while adding hardware multitasking abilities. CIRCLE 443 ON READER SERVICE CARD Stephen Manes and Paul Somerson who, as the elusive Ward Starr and Mel Murch. originally penned that WordStor broadside in 1983.

There are multiple fixes on the single disk, including a rescue program that's a simple save for up to 20 pages of lost text and a file fixer that automatically strips control codes and dot commands from text files (for shipping them over MCI mail, for example). Four programs that train your WordStor disk to handle 43-line EGA screens are also provided.

However, the program's main fare are the StarFixer and KeyFixer programs that directly modify your WordStor's WS.COM file. These quick fixes have been over 10,000 hours in the making.

For those with blind trust in the experts, StarFixer even comes with an Instant Fix key (I) which optimally reconfigures the program all at once. For those who prefer to do it themselves, a wide range of customization options are easily accessed from WordStar-looking menus. In fact, if the program has one particular strong point it's the sameness of all its menus-making it easy to work with and easy to use even by the



StarF ixer Hard/Soft Press Inc. P.O. Box 1277Z Riverdale, NY 10471 List Price: \$29.95, plus \$2

Requires: WordStar 3.0 or

In Short: A comprehensive fixti shop for WordStar's famed foibles. Text rescue and key customization programs are also included. The Cirl-Y fix alone is worth the price. Not copy protected. CIRCLE 445 ON READER SERVICE CARD

ingrained WordStar rank and

Moreover, the program's customization commands are much simpler to use than those obtainable with WordStor's own Install program. An additional dot menu allows you to change all the line and page length defaults. The function key label line can be toggled off for additional screen space. The rub-out direction of the backspace and Del keys can be modified. And the program can be hot-wired to bypass WordStor's

What is possibly its most famous fix changes the line-delete command to back-to-back (as opposed to a single) Ctrl-Ys, a security step against slipped

opening message.

Ctrl-Ts. As an added attraction, Key-Fixer lets you customize and reinforce your function keys with extras. Ten extra function keys can be added. These additional keys, as well as the normal function and cursor pad keys, can also be customized for your convenience. And if you should ever get sick of all this extravagant key muddling, you can instantly reset the program to its factory default settings.

You'll probably never glance at those factory defaults again once you hot rod your WordStor with this StorFixer. WordStor. Release 4.0. it's not. But it may already be more than you need.

Halo DPE: As a Page Design Tool, It's a Great Drawing Aid



BY TOM STANTON Holo DPE (Desktop Publishing Editor) has some interesting features as a drawing program and some astounding flaws as a publishing package. At first glance, the software is identical to the original Dr. Holo II. which costs \$60 less, but there are a number of enhancements, including scanner input, expanded memory support, and output to IMG and TIFF graphics file formats. A frame grabber, a slide show program, and numerous fonts are also included, and like its predecessor Halo DPE has an impressive list of hardware support-there are drivers for most pointing devices and display adapters.

As a graphics program, Halo DPE has few peers, but it's the DPE part that bothers me most. On the surface it looks easy. Since you can import text from any ASCII file. I selected one of my test documents. Surprise-Halo DPE treats text as one graphics block, so unless you have formatted the text into the desired column width in advance, you get a block of text.

There are no editing functions, in spite of the title. You cannot change fonts or change sizes once the text appears in Halo DPE, which treats graphics as bit-mapped images. You can move blocks of text, but there is no way to readjust the change the column width, or redo column formats. There are no page guides to hold the text in place-you point and shoot and hope for the best.

Worst of all, each column of text must be in a separate ASCII file. If you import a long file, you lose text that goes beyond the page margin. If you're using graphics, you must also calculate the depth of the graphics be-



design elements as static graphics it's a weak publishing and.

FACT

Halo DPE Media Cybernetics Inc

8484 Georgia Ave Silver Spring, MD 20910 (800) 446-HALO (301) 495-3305 List Price: \$199.95

Requires: DOS 2.0 or later In Short: An enhanced version of Dr. Holo II that allows mereing of text and graphics on a page. It's long on graphics but short on support for managing text. Not copy protected. OFFICE 433 ON READER SERVICE CAR

fore you can decide how long you must make each column (again, each in a separate file). To Holo DPE's credit, there

is an invisible grid function that helps with text alignment, and a virtual page, which displays an approximation of the finished page. Both features are useful. but they hardly make up for the work required to produce a finished page.

If you're looking for an excellent graphics program, Halo DPE is it. As a publishing program, it barely qualifies.

Mix C Works' Blend of Tools Is a Good Choice for a Novice



BY J.H. SMITH The Mix C Works combines a compiler, linker, editor, and full-screen debugger for \$89.95. The compiler, sold separately for \$39.95, is aimed at

novice C programmers. The language tutorial is enough to teach the language. The compiler is reasonably quick, but the resulting programs are somewhat slow and large. It produces nonstandard object files, handled by an included linker. Source code is provided for about half the functions: more comments would

If your program can't compile, errors will be pointed to in the listing with a numeric code. You'll find readable messages only at the end of the listing. That's no way to treat a novice!

If you compile from within the split-screen editor, you'll be directed to the first error, and a readable message will be shown at the bottom of the screen. The editor's documentation is too intimidating; it's full of setup instructions for CP/M. There's no tutorial, and the PC-specific commands are hidden in an appendix.

The debugger is genuinely helpful, the best part of the package. Even beginners will

have no trouble tracing through the code, seeing variables change and setting breakpoints. A language as complex and hostile as C is much easier with a tool like Mix C Works Overall, Mix C Works is a

good package for learning C. Unlike Turbo Pascal and Quick-BASIC, it's not appropriate for developing commercial software on a tight budget. An expected \$39.95 large-model urgrade may change that, but for now, novices will get the most out of Mix C Works.



Mix C Works Mix Software 1132 Commerce Dr Richardson, TX 75081 (800) 523-9520

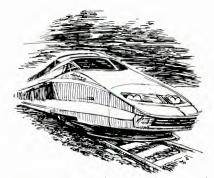
2.0 or later

(214) 783-6001 List Price: \$89.90; \$39.95 for compiler and linker alone:

\$39.95 for Ctrace debugger alone; \$29.95 for editor alone; \$10 for ASM utility alone. Requires: 256K RAM, DOS

In Short: It's not a professional development environment but is a good tool for novices wanting to learn the C programming language. Not copy protected.

CIRCLE 429 ON BEADER SERVICE CAR



How a French train inspired the fastest 286 micro you can buy.

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"Grande Viterse" mesms kigh speed—in this case, 12Mh; with no ware states

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The cache circuit also assures high reliability, allowing the GV-286 to operate it super-high speeds without pushing its integrated circuits beyond their design limits. Other 12MHz machines put their ICS through hell to achieve high speed, and that means they're inherently less reliable.

Yer with all this speed and design innovation, PC Designs engineers—unlike other manufacturers have customized the BiOS and retained the standard IBM PC AT bus timing (yet another PC Designs exclusive). The result is unparalleled

compatibility with existing software and peripherals. There's a boncar load of other design features and the GV 256 can be codered up in virtually any configuration you can imagine. Best of all, standard systems start at less than \$4000 (uncluding Designer multitaking software).

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Bookmark Saves Snapshots of RAM and Video Memory on Disk



BY WINN L. ROSCH

Unless you're carefully balancing international relationships and Swiss bank accounts, the biggest advantage of using a computer is also its biggest disadvantage. All your work is transitory: simple electronic flashes that are apt to evaporate at the slightest hiccup in the power supply or when an experimental program runs awry

Bookmark, from Intellisoft International, is aimed at ensuring your work doesn't disappear without your approval.

It makes the fleeting electronic memory of your PC more permanent by stealthily copying its contents to disk while you are at work on something else. This memory save works both man-

You can simply press a couple of keys and Bookmark will write a snapshot of your PC's full RAM complement and display memory to a hidden directory on your hard disk. Or the program will automatically make its saves periodically, at fixed intervals or number of

keystrokes or both Bookmark works like a bookmarker because it allows you to instantly reload your memory snapshot, so that you're dumped right back into the exact place you were when the save was made-programs loaded, data files open, same directories logged, and every-

thing executing. Restoring the entire system configuration requires only a couple of seconds, and the memory-restoration process can Although it's a truly clever

idea. Bookmark has its shortcomings. You lose the amount of hard disk space (the program requires a hard disk) equal to one or two times (depending on operating mode) your total system RAM and display memory. Bookmark will not save anything in extended or expanded memory or the memory used by nonstandard display adapters.

It misses a few details, such as screen border colors and timer settings. And it's copy protected using the Super-Lok (Softguard) system, so backing up Bookmark is troublesome at best.

Memory resident, Bookmark requires only 6K bytes of RAM. Its installation process is menu driven, short and sweet, as is the documentation.



Intellisoft International 70 Digital Dr. Novato, CA 94948 (800) 544-6275 (800) 543-6275 (in Calif.) List Price: \$69.95 Requires: 64K RAM, hard disk, DOS 2.1 or later. In Short: A place-saving system that automatically copies the contents of RAM to disk. The RAM copy can be quickly restored, putting you back where you were when the save was made. Copy protected. CIRCLE 431 ON READER SERVICE CAR

Less expensive than a power backup system and as reliable as a guilty conscience, Bookmark may help you avoid disasters-particularly if you're irresponsible enough to forget to regularly save your work.

Princeton LS300: Easy Scanning; Strong on Zoom, Weak Documentation

PC HANDS ON

BY TOM STANTON The name Princeton Graphics Systems is synonymous with monitors, so I was surprised to see that its latest offering, the Princeton LS300 Scanner, is a desktop graphics scanner system. The LS300 is, in fact, the Canon IX-12 scanning engine, with no notable changes.

The LS300 scanner is well designed and easy to use. It has a small footprint (13 by 111/2 inches), which makes it ideal for desktop use. The paper path is ideal: pages feed directly from front to back with only a slight bend at the output tray, which makes it perfect for photographs, transparencies, and mylar, where too much bending course the medium in crack.

The LS300 uses a special interface card that fits in the short

slot of your PC. Jumpers on the 1 card allow you to configure the DMA (direct memory access) channel and the hex address if the factory settings conflict with other boards on your system.

The LS300 uses PC Paintbrush Plus as its scanner interface-a big improvement over inch), and the scan mode. The LS300 supports black-andwhite scanning (line drawing), and a dither mode, which is used to scan photographs and other images with continuous tones. Dithering is similar to halftoning and screening, but can't scale an image without

many scanners because you can scan, edit, and print before committing an image to disk. The Scan Options dialog box lets you set brightness, contrast, resolution (up to 300 dots per

The Princeton I \$300's paper tray is well tioned for scanning fragile artwork. a noticeable

loss of detail. The ability to alter the image in detail using the Zoom feature gives this product a big advantage over many other scanners

that rely on screen grabbers or their own graphics editors The Princeton Graphics documentation shows you only how to install the hardware-after

FACT

Princeton LS300 Scanner

Princeton Graphics Systems 601 Ewing St Princeton, NJ 08540 (800) 221-1490 (609) 683-1660

List Price: \$1,095 Requires: 320K RAM, mot DOS 2.0 or later

In Short: A 75- to 300-dot-perinch scanner that uses PC Paintbrush Plus as the scanning interface. It scans line art and photographs for editing and printing or to store on disk. CIRCLE 459 ON READER SERVICE CAR

that you're on your own. This is unfortunate because it has a nice product that is easy to use once you've installed it. Its biggest limitation is the dithering of halftones, but even there it does a respectable job. The LS300 is a good candidate for users who want a general-purpose scanner for desktop publishing.

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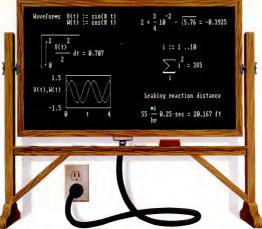
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MallicAl

CIRCLE 154 ON READER SERVICE CARD

■ OUICK LOOKS

Envelope Please Picks Up Addresses



HANDS ON

BY JONATHAN MATZKIN The Envelope Please, from Quaid Software, allows dot matrix printers to accept-and print-envelopes the long way. That makes it easier to entice the envelope into the wilds of your printer carriage, a place where envelopes normally fear to

Uses Address Window

The memory-resident program pops up over vour word processor; you simply position and size the address window over the inside address of the letter. The Envelope Please picks up the address and prints it on your envelope, along with a

gram.

return address that you can I may be, depending on your specify when you set up the pro- printer. Not all printers are designed to accept envelopes, and Sound too good to be true? It | The Envelope Please is not

PL R BE DE HOPE BEFORE RE

Charile Jeses 17-18 Liberty Avenus Woodheves, New York 11417

I have received your letter of the 3rd, and I west any that I am extremely disarrolated. Your versice of the events is quite different from my

To print an envelope using The Envelope Please, from Quand Software, the user pops up a frame over the address and tota Return.

compatible with all makes and models

I got good results with an Epson FX-85, but it took some trial runs before I learned to position the envelope so it would travel properly through the paper path. And the sideways print, while quite readable, is primitive compared with the usual output from a dot matrix machine.

The program prints in the standard fashion on daisy wheel printers; support for laser printers is on the way List Price: The Envelope Please.

\$30 Remiles: Enson-compatible friction-feed dot matrix or daisy wheel printer. Not copy protected. Quaid Software Ltd., 45 Charles St. East, Third Floor, Toronto, Ontario, Canada M4Y 1S2; (416) 961-8743

CIRCLE 421 ON READER SERVICE CARD discussed and examples are

Assembler Book Teaches by Example

HANDS ON

BY ETHAN WINER What makes Peter Norton's As-

sembly Language Book for the IBM PC stand out is not merely that it was written by PC wizard Peter Norton and partner-inprogramming John Socha but the manner in which the material is presented. The book's strategy is for you to work with the authors in building a complete sector-editing utility.

Many interesting and useful tricks of the trade are presented along the way, and a number of the macro assembler's lesserknown features are discussed. Norton's clear, straightfor-

ward writing style is evident throughout, making the book both enjoyable and easy to read. But what I appreciate most of all is the accuracy of the material, as well as the depth of coverage provided. While many other beginner tutorials gloss over much of the assembler's more-advanced capabilities. Norton and Socha leave no. stone unturned.

For example, rather than

have the reader build a single large program, a number of separate modules are created. which are then linked together. By doing this, the concepts of Public and External procedures become understandable as well as the techniques that are required to make large programs. A number of shortcuts are also illustrated, with the emphasis being on faster and more efficient code. And though they stop just short of counting individual processor clock cycles to achieve this, the concepts are shown List Price: Peter Norton's

Assembly Language Book for the IBM PC by Peter Norton and John Socha, \$19.95. Convrient: 1986.

Brady/Prentice Hall Press, One Gulf + Western Plaza, New York, NY 10023; (212) 373-8500.

CIRCLE 422 ON READER SERVICE CARD

Pizazz Puts New Life in PrtSc Kev

HANDS ON

BY JONATHAN MATZKIN Has the fun gone out of the romance with your printer? Well. perhaps what you need is a little Pizazz to make things exciting again. Technically, Pizazz is a memory-resident print utility, but it is really more like a turbocharger for your PrtSc key. It takes the place of DOS's plain-

vanilla screen print program and provides you with all sorts of new options. Tapping Shift-PrtSc pops Pizazz up over any screen that you want to print and presents a main menu. The program looks at the image to be printed and

takes note of displayed colors. Each displayed color can be replaced and printed with any of over 200 available shades. Monochrome printers have

access to 30 different shades and fill patterns, and images can be printed with standard or reversed black-and-white and color relationships.

But Pizazz is not simply a palette. It has some of the image manipulation capabilities normally associated with packages like Freelance or EGA Paint. The displayed image can be rotated or sized, and a "smooth" function helps minimize jaggics.

You can also place a variably sized window over a por-

tion of the screen and print the contents of the window. The program will also store an image, along with all selected settings, in a file. That file can be printed out with the same results on any other system, within the

limits of the printer used. And, in case you really want to use it, Pizazz has a menu option for DOS's print-screen function. But that's an option

that clearly lacks pizazz by comparison. List Price: Pizazz. \$49.95. Requires: 32K RAM. Not copy protected. Application Techniques

Inc., 10 Lomar Park Dr., Pepperell, MA 01463; (617) 433-5201

CIRCLE 423 ON READER SERVICE CARD

■ NEW ON THE MARKET ■ JONATHAN MATZKIN



PhoneBoot is a \$329 combination surve suppressor/remote boot-up device that can be accessed by selephone

PhoneBoot Combines Remote Power-up and Line Surge Suppression

PhoneBoot, \$329 from Cybex Corp., gives a user access to a PC from any remote phone. The device monitors incoming ring signals, answers after eight rings, and prompts the caller for a three-digit security code that is sent via telephone touch-tones or through a Hayes-compatible modem

Upon receiving a correct access code. PhoneBoot powers up the PC. When used with a modem, the system allows remote access and automatically shuts off 15 minutes after the caller hangs up. List Price: PhoneBoot, \$329.

Cybex Corp., 1860-B Sparkman Dr., Huntsville, AL 35816; (205) CIPCLE 439 ON READER SERVICE CARD

830-1100.

Inexpensive Memory Manager Taps Power Of 80386 Processors

Quarterdeck Office Systems has introduced a software-based expanded memory manager for 80386-based PCs. The \$59.95 Quarterdeck Expanded Memory Manager-386 (QEMM) lets users access Lotus/Intel/Microsoft expanded memory on a 386 machine without the need for an additional expanded memory board

OEMM uses the 80386 chip's virtual 86 machine mode to emulate expanded memory and gives the 80386 machine's extended memory the characteristics of expanded memory. When used with DESQview, Quarterdeck's multitasking environment, OEMM lets users | run as many as nine programs, all using expanded memory for data, simultaneously.

OEMM differs from Compag's expanded memory manager in that it can be used with both 80386-based PCs and with 386 add-in cards like Intel's In-Board-386, Ouarterdeck says.

HOT PROSPECT New Macs to Run DOS Software Using

AST's Coprocessor Plug-in Boards AST Research will sell addin boards for the latest generation of Macintosh computers, enabling the Mac SE and the Mac II to run MS-

DOS programs. The \$599 Mac86 coprocessor board features a 10-MHz Intel 8086 CPU and installs in the single expansion slot of Apple's new Macintosh SE. The Mac86 runs any MS-DOS application that supports the IBM Monochrome Display Adapter or Color/Graphics Adapter. The 8086 coprocessor shares the Macintosh SE's internal memory

with the host Motorola

68000 processor that is in the

Mac SE. The Mac86 provides a controller for a 51/4-inch MS-DOS floppy disk drive, which is required for MS-DOS processing, and must be added separately. When installed, the MS-DOS environment appears as an icon that can be called from the Mac's Finder as a normal

Macintosh application. The \$1,499 Mac286 is a self-contained 80286-based microcomputer that plugs into two adjacent NuBus slots in the Mac II. A two-



List Price: Ouarterdeck Expanded Memory Manager-386, \$59.95. Remulres: 80386-based PC or PC equipped with add-in 80386 board. Not copy protected. Quarterdeck Office Systems, 150 Pico Blvd., Santa Monica, CA 90405: (213) 392-9851.

CIRCLE 440 ON READER SERVICE CARD

board set. Mac286 comes with I megabyte of RAM, a direct memory access controller, a socket for an optional 80287 math coprocessor, and a 51/4-inch MS-DOS floppy disk drive controller. When running MS-DOS software, the Mac286 handles all applications processing, while the Mac controls I/O functions. An external 51/4-inch floppy disk drive is required Once loaded DOS applications run in a window in the Mac II's 12-Inch

AST expects to ship both products in late spring. List Price: Mac86, \$599. Mac286, \$1,499, Requires Macintosh SE (for Mac86) or Macintosh II (for Mac286), external 51/4-inch MS-DOS disk drive. AST Research Inc., 2121 Alton Ave . Irvine CA 92714:

(714) 863-1333. CIPICLE 404 ON READER SERVICE CARE



Left, the \$1,499 Mar 286 harred room DOS applications on the Macintosh II: it contains an Intel 80286 and I megabyte of RAM, Above, AST a Mac86 plugs into the Mac SE; it contains an Intel 8086 and shares RAM with the Mac.

Project Management Package is Targeted at

All Business Managers Project Vision, \$349 from Inmax International Publishing, is a project management program that isn't just for professional project managers, according to Inmax. The software features a spreadsheet-style user interface and can present information in the form of a unique "box precedence" diagram. The diagram can be roomed in on or scrolled.

Project Vision also has a text editor for development of project documentation and a report generator, Inmax emphasizes ease of use and says the program can be quickly learned and put to productive use, making it a good choice for managers seekine an introduction to project planning techniques.

List Price: Prairet Vision, \$349. Regulres: 256K RAM; one disk drive: IBM-, EGA-, or Herculescompatible graphics adapter: IBM graphics printer. Epson FX-80 or FX-100, or compatible printer. Not copy protected. Inmax International Publishing Ltd., #560, 1380 Burrard St.,

Vancouver British Columbia Canada V62 2H3: (604) 689-7100.

CIRCLE 442 ON READER SERVICE CARD

Dot Matrix Printers: One Is Fast, the Other

Has Network Features New serial dot matrix printers from Output Technology Corp. offer blinding speed and eye-opening connectivity fea-

The \$2,395 TriMatrix 850XL charges through print jobs with a burst speed of 850 characters per second and a throughput of 240 lines per minute, Output Technology says. The printer handles 80-column applications but is optimized for 136-column printing. The 850XL offers features that can be found on the earlier 700 series printers, including frontpanel programming, front and bottom paper feed, 8K-byte data buffers, and Epson and

AdaptaPak \$399 Battery for Toshiba T3100 Frees Laptop from AC Power

For all its power and features, users who want Toshiba's 80286-based T3100 laptop is limited by its power cord. The T3100 can operate only as far from an AC outlet as the cord will stretch. So Prod-Called uct R&D Corp. has introduced the \$399 AdaptaPak, an adapter, battery, and charger kit that gives the T3100 computing mobility. R&D says AdaptaPak

provides over an hour of comnutine time for the Toshiba The adapter is available without battery, for \$299, for to run the T3100 off a car cigarette lighter or select their own 12-volt battery. the Adapta80, the adapter-only version fits with the T3100 inside the lanton's

carrying case and weighs a mere pound List Price: AdaptaPak, \$399. Adapta80, \$299. Product R&D

Corp., 1194 Pacific St., #201, San Luis Obisno, CA 93401: (805) 546-

CIRCLE 437 ON READER SERVICE CARD face. The Padolock system is

apter/butters

wiRAD frees

T3100 users

from laptop's

nower cord

DEC printer emulations. The TriMatrix 850 PrintNet. which costs \$2,995, adds networking capabilities to the speed of the 850XL. Up to five users can connect simultaneously to the 850 PrintNet through resident serial ports. The printer serves not only as a multiuser print station but also as the basis for a simple plug-and-play network

Any device capable of serial communications - including computers, modems, and other printers-can be connected to the 850 PrintNet and exchange data in RS-232C or RS-422 formats at speeds up to 19.2K bits ner second.

List Price: TriMatrix 850XL, \$2,395. TriMatrix 850 PrintNet. \$2,995. Output Technology Corp., E. 9922 Montgomery, #6, Spokane, WA 99206; (509) 926-3855

CIRCLE 436 ON READER SERVICE CARD

New Security System Utilizes Steel Plates to

Prevent Theft of PC Computers don't have legs, but they do sometimes walk away when left unattended. Doss Industries has introduced the \$89.95 Padolock security system to help keep your PC on

your desk, where it belongs. Two interlocking steel pads and an acrylic adhesive fix a PC

user installable without cables or drilling, according to Doss Industries. Each system comes with an offer from Safeware Insurance Co. to provide coverage for your equipment. List Price: Padolock \$89.95 Doss Industries, 1224 Mariposa St., San Francisco, CA 94107: (415) 861-

CIRCLE 438 ON READER SERVICE CARD or compatible, printer, or other



\$89.95 Padalock, which employs steel construction and an acrylic adhesive

Bridge Connects Up to 32 Different NetWare LANS Simultaneously

Connectivity, like the universe, continues to expand at high speed. New products like G/Remote Bridge from Gateway Communications link individual LANs to produce a new level of connectivity

G/Remote Bridge transparently connects any NetWarebased LAN to any other NetWare-based LAN. The bridge is immediately available to more than 37 types of networks offered by LAN suppli-

ers, according to Gateway. G/Remote Bridge is a combination of hardware and software that creates a virtual link between remote LANs as a nacket assembler/disassembler interface over x.25 trunk lines, public data networks, or private data networks. As many as 32 LANs can be connected at one time. Gateway says that because G/Remote Bridge uses the X.25 protocol, LAN transmission speeds of up to 19.2K bits per second are achieved.

List Price: G/Remote Bridge. \$2,990 for starter kit that includes everything needed to connect two

LANs; G/Remote Bridge Link, for connecting additional LANs. \$1,595; G/Remote PC, for connecting remote PC to LAN.

\$795. Requires: At least two NetWare-based LANs with nondedicated PCs as communications servers. Not copy

protected. Gateway Communications Inc. 2941 Alton. Ave., Irvine, CA 92714; (714) 553-1555

CIRCLE 441 ON READER SERVICE CARD

Hercules Develops Color Graphics Card That Is Compatible with Its Software

Known as a standard setter for monochrome graphics, Hercules Computer Technology is maintaining compatibility with the Hercules body of software drivers, while setting a new standard for color graphics. The Hercules InColor card displays 16 colors at a time from a palette of 64, with 720- by 348-pixel resolution

The board also displays any application in white on black or in two other user-selected colors. Color drivers have already

been developed for AutoCAD, 1-2-3, Symphony, and Microsoft Windows, and Hercules expects all popular Hercules-compatible programs to support the InColor card shortly. The card supports an ex-

> Hercules Compar-\$499 InColor card brings full color to software that supports the Hercules rrunhics standard.

panded version of the RamFont display mode, which gives applications programs access to a library of up to 3.072 softwaredefinable characters or patterns. displayed in up to 16 colors. List Price: InColor, \$499.

Regutres: ECD or multisync monitor. Hercules Computer Technology, 2550 Ninth St., Berkeley, CA 94710; (800) 532-

CIRCLE 438 ON READER STRAIGE CAN

Xerox Puts Spelling Checker in a Box That Uses No RAM or Slot



HANDS ON

BY MITT JONES Xerox Corp.'s PC Type Right manages the minor miracle of putting a 100,000-word spelling checker at your service while staving out of your way and taking none of your expansion

slots, RAM, or ports Just plug your keyboard into Type Right and plug Type Right's cable into your system's keyboard jack, and you've got a spelling checker that spots errors as fast as you can crank them out. Whereas most spelling checkers operate in batch mode. Type Right checks for errors as you type by monitoring keyboard scan codes. When you type a word it doesn't hold in its dictionary, Type Right beeps

Since it monitors your typing without regard to what software you're using, Type Right will sometimes nag at your spelling when you're correct-such as when you change directories or start your word processor. But Xerox included two remedies for that problem. You can easily turn spelling checking off by entering Alt-Asterisk (on the keypad), or you can add up to 1,200 words to a secondary dictionary.



PC Type Right patches into the keyboard jack, so all keystrokes are monitored. No loss of input speed is noticeable.

To add to the dictionary, you type the appropriate word and then enter Alt-Plus sign. You can remove words just as easily. I left Type Right on all the time and found it very easy to live with once I added the most-

common DOS commands, my batch-file names, and my directory names. However, I still got an occasional beep for unrecognized words when I entered some applications programs' commands.

Perhaps Type Right's mostimpressive feature is its ability to keep track of changes you make on the current line. Until you move to a new line, you can edit using the Backspace, Del, Ins, and cursor keys without Type Right losing track of the words. For instance, you can type person computer and then cursor over and add al to person without causing an error

To account for the different ways programs define the Backspace, Del, and Ins keys, Type Right offers six different edit modes. The thorough documen-



PC Type Right Xerox Corp. Xerox Sq. Rochester, NY 14644 (800) 822-2200 List Price: \$199.95 cable.

In Short: A unique approach to spelling checking that works with all software and doesn't crowd your system's resources.

tation lists the suggested mode for 34 programs, including the most-used word processing programs and other giants such as dBASE III, 1-2-3, and Symphony. The modes help Type Right keep track of only changes you make, so sticking with the mode for your most-used program won't render Type Right useless for other applications

If you use a word processor that includes a batch spelling checker, Type Right may be a great product you don't need. But for a friendly, versatile spelling checker, it's hard to

Turbofonts Generates More Than 1.000 Special Characters



BY EDWARD MENDELSON If you need more than the 256 characters on the IBM PC, Image Processing Software's Turbofonts can change them. This resident program replaces IBM's higher-order character set-the foreign and graphics characters above ASCII 127-with predefined sets of characters that your monitor

displays and, amazingly, your Turbofonts' characters range from foreign letters to scientific symbols to fragments that you can combine for equations or

printer prints.

like the 30 predefined sets, you can build your own from a 1,000-character library. Most every Western language is supported, as well as Hebrew, classical Greek, and Cyrillic alphabets; only a romanized Arabic is included. You can modify the characters or design new ones from scratch. A separate feature allows you to import a graphics file into any word processing document.

double-size letters. If you don't

The program works most smoothly with an EGA or a Hercules Graphics Card Plus; other boards require replacement PROM chips and won't let you edit the characters displayed. It like WordPerfect that know how to handle IBM's higher-order characters and don't fill the screen with graphics characters that Turbofonts might alter. Some of the supplied character sets make the frame in Microsoft Word and the ruler in Xv-Write look incongruously ornate. Don't even try to use the program effectively with Word-

Turbofonts intercepts files on their way to the printer and inserts strings that generate the specially defined characters. Almost every standard elet matrix printer is supported. The FACT

Turbofonts, Version 1.2 Image Processing Software Inc. 4414 Regent St. Madison, WI 53705 (608) 233-5033 List Peice: \$140

Requires: 15-40K RAM beyond the needs of the word processing program used with it. DOS 2.0 or later. EGA or Hercules Graphics Card Plus recommended: other display boards require a replacement

PROM (\$75 each) In Short: A resident program for viewing and printing non-IBM characters and symbols. It works efficiently but is awkward to install and customize

Not copy protected CIRCLE 428 ON READER SERVICE CA



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BY MITT IONES Several manufacturers have announced bigger-than-life monitors in the works, but Aydin Controls and Epsilon Graphics Systems are already shipping 19-inch monitors that display EGA graphics like you've never

seen them before. Both monitors claim a good deal of real estate-and don't try to move them if you've got a bad back. But for small meetings, detailed graphics work, and control-room applications, these monsters are well worth their bulk. Unlike other 19-inch displays from Genius and Moniterm Corn. these monitors run off standard EGA adapters.

The Aydin Patriot Enhancer is IBM Enhanced Color Display compatible, able to display either CGA or EGA graphics and to switch between modes automatically.

The monitor worked flawlessly with all the software and EGA-compatible display adapters I tried. Its antireflective screen surface keeps glare to a minimum, and the 16 colors are

dazzling on the large display. I The brown looks brown, and I especially liked the richness of the blue and green. But the Enhancer offers richness and depth at the cost of brightness-the white and yellow seemed pale compared to IBM's Enhanced Color Display.

With a respectable dot pitch of .31 millimeter, the Enhancer delivers well-formed text that's of the cabinet is labeled contrast, but it seems to control brightness instead. A brightness control, which one can only assume would control contrast, is

Epsilon's EG-19 Enhanced Graphics Display is actually a 19-inch Mitsubishi C3922K analog color monitor. An Epsilonmade EGA interface box enables it to display EGA



Aydin Patriot Enhancer Aydin Controls 414 Commerce Dr. Fort Washington, PA 19034

(215) 542-7800 List Price: \$2,700: tilt-swivel monitor stand \$175 In Short: A 19-inch EGA monitor versatile enough for presentations or general use.

ORCLE 424 ON READER SERVICE CARD EG-19 Enhanced Graphics Epsilon Graphics Systems

1370 E. Edinger Ave. Santa Ana. CA 92705 (714) 558-1288 List Price: \$1,995 In Short: A 19-inch monitor

that does a nice job of displaying EGA graphics but can't display CGA graphics

CIRCLE 425 ON READER SERVICE CARD

its inability to display CGA graphics. The screen goes blank or scrolls if the scan rate alters from the EGA frequency, rendering the manitor useless for many applications.

Epsilon attempts to sidesten the limitation by including a pass-through port for a true (continues on page 51)

character box in monochrome mode. The EGM-1 and En-

hanced Graphics Adapter are

solid products for a decent price

and a smart way to upgrade to

-By Mitt Jones



Left to right English's EG.

19. the IBM ECD, and Av-

dm's Patriot Enhancer du-

laid out the controls. The only

control you'll find on the front

Velcro to the rear of the cabinet. But the biggest drawback to the EG-19-which costs \$700 less than Avdin's Enhancer-is With 256K bytes of RAM

Tandy Does EGA

Tandy/Radio Shack's new EGM-1 Enhanced Graphics Monitor doesn't leave much room for improvement. Its colors match or better those of the IBM Enhanced Color Display. and its 14-inch glare-resistant screen is a bit larger than most displays. The EGM-1's highbrightness level and .31-millimeter pixel size make for easyto-read text.

While the monitor sells for \$699, the company is offering its no-frills EGA-compatible display adapter, the Tandy Enhanced Graphics Adapter, for 5349.95. The full-lemed card follows the industry standard, so you're still out of luck if you own a Tandy 1000EX, which uses special proprietary Tandy boards. Like most EGA-compatible adapters, the card uses the Chips and Technologies' CHIPSet, but Tandy dispensed with the RCA jacks that have become probably the least-used industry standard.

on-board, the adapter supports 16 colors at 640 by 350 resolution and generates a 14- by 8character box in EGA mode. The Tandy display card also supports IBM's standard CGA resolutions, as well as 640 by 350 graphics and a 14- by 9-

Filling a gap in its

product line, Tandy

built its EGA subsys-

sem with the ubiqui

nologies EGA chip

set. The only non-

standard design ele

ment on the board is

the lock of an RCA

tous Chips and Tech

Tandy Enhanced Graphics EGM-I Enhanced Graphics Monitor Tandy/Radio Shack 1700 One Tandy Center Fort Worth, TX 76102

(817) 390-3300 List Price: FGM-1, \$699: Enhanced Graphics Adapter, \$349.95. In Short: An EGA graphics

combination that offers brilliant colors at a reasonable price CIRCLE 426 ON READER SERVICE CARD



PROBLEM: The more experience your hard disk has, the harder it has to work.

THE SOFTLOGIC SOLUTION: Disk Optimizer

Your hard disk will run faster when it's not chasing around after files.

Remember the old days when your hard drive was new? Remember that smooth, fast, slick performance? Those quick retrievals, rapid saves, lightning-like database sorts? Well ever since, DOS has been doing its best to slow your hard drive down. Not

best to slow your hard drive down. Not by slowing down the motor, but by breaking your files up into pieces. Storing different chunks in different places. Data files, programs, overlays and batches that started out in one seamless piece are now

Scattered all over.

Loading is slower.

Sorting is slower.

Retrieving takes looper because

Everything takes longer because your disk has to work harder. Problem is, it's something that happens so gradually you may not notice the difference. At least, not until you see the dramatic

improvement after using Disk Optimizer. File fragmentation—It's a problem

File fragmentation—It's a prob you can see.

Watch your hard drive the next time is reads or writes a file. Each "blip" of the LED means the drive-head is moving to another place on the disk—either to pick up or lay

down another chunk of data.

And the truth is, head movement takes time. Far more time than actual reading and writing. What's worse, all this head movement causes extra wear and tear that can

Disk Optimizer—Tunes up your disk by cleaning up your files.

shorten the life of your drive.

Disk Optimizer works by finding all the scattered pieces of your files and putting them back together where they belong. Next rime your drive reads it, there's just one place

And the results are often dramaric. Reading and writing times may be cut by as much as two thirds. Database sorts that used to take hundreds of head moves now proceed quickly and efficiently. And since head movement is now at an absolute minimum, your disk drive will lead a longer, more productive life.

Analyze, scrutinize, optimize.

Before you optimize, you'll probably want to analyze. So Disk Optimizer shows you, in percentages, how much fragmentation has taken place—on the entire disk, in individual directories, or for groups of

files you specify using global or wildcard names. Plus, there's built-in data security that lets you assign passwords to as many files or

file groups as you want.

And the File Peeker gives
you an inside look at the
structure of files. It's a great
way for non-programmers to

structure of files. It's a great way for non-programmers to learn more about computers and a powerful tool for professionals who want to analyze the contents of their disks.

Get your hard disk back in shape—with new improved Version 2.0

Hard to believe, but new Disk Optimizer Version 2.0 is e even better than before. Not only will it optimize your disks in far less time than it used to, but it actually speeds up retrievals even more by letting you give priority treat-

ment to your most used files, like programs and batches. When you think about it, it's simple.

The longer you own your hard drive, the more you come to depend on it. But the longer you wait to get Disk Optimizer, the less performance you'll get.

longer you wait to get Disk Optimizer, the less performance you'll get. Use it just once and discover what thousands of satisfied PC users already know— \$59.95 is a small price to pay to restore the speed and performance you count on.

the speed and performance you count on. See Disk Optimizer at better computer dealers everywhere, or order today by calling SoftEogic Solutions at 800-272-9900 (603-627-9900 in NH). Or mail the coupon below.

🔇 Disk O			
YES! I want to put t Send me copi Name	he zip back es of Disk C	in my har Optimiter	d disk. right away.
Company			
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CIRCLE 492 ON READER SERVICE CARD

Smoother than 1-2-3, Silk Has Text Search, Keystroke Logs



BY JARED TAYLOR Silk is the latest spreadsheet to slide into the market, claiming to be a 1-2-3 killer. Advertising itself as everything a 1-2-3. Release 3.0, would be and more, it comes with a host of fine fea-

Although by no means a clone, Silk is highly compatible with Release 2 of 1-2-3. Some macros and a few offbeat functions are not compatible, but you can translate models back and forth without much fuss.

The 20-line screen looks very much like 1-2-3's and the Slash-key, two-line menus are standard spreadsheet fare. Some simple commands like /qy and /fr are identical, but most commands are original. One of Silk's real draws is "live" help. When you turn it on, the right half of the screen becomes a constant tutor, upevery time you make a move.

dating to explain your options Silk has made the screen the primary documentation, putting only an overview and tutorial in the manual. Other major fea- I tures include search and searchand-replace, which work for both labels and formulas.

Silk also has a novel modelsaving technique. As you build

doesn't have the data query features of 1-2-3, it includes single-cell goal seeking, which tells you what price you must charge to get a certain profit. It also does data allocation, so that a spreadsheet, it saves your keyif you specify a sum, the com-



With help active, the right half of a Silk screen updates with a new help test to describe your options at every step in a command. In the left half of the screen Silk displays highbit ASCII characters with the chartx1 function

strokes to a hard disk file called KEYSTROK.LOG. If you lose your work, you can read the log file, and Silk will rebuild your model, step by step. It takes a little time, but it's quicker than doing it yourself. Though Silk

ponents of that sum will adjust proportionately Silk lets you build time-se-

ries models somewhat like Javelin's. Establish time periods across the top row and put Sales, Expenses, Profits, and so FACT

Daybreak Technologies Inc. 2271 205th St Torrance, CA 90501 (213) 212-3030 List Price: \$298 Requires: 512K RAM, two disk drives, DOS 2.0 or later. In Short: It's an excellent spreadsheet, with extremely good interactive help. Has a

CIRCLE 430 ON READER SERVICE CARD on, in the rows beneath. You can then define formulas such as Profits = Sales - Expenses, and every cell in the Profits row will show that period's profits. Silk lets you write formulas

high RAM requirement. Not copy protected

up to 4,000 characters long and gives you a half-screen window to edit them in if you need it. You can tack useful comments onto the ends of formulas and track down circular references with a single key stroke.

Feature for feature, Silk looks like a better spreadsheet than 1-2-3. "Nothing runs as smooth as Silk," claim the ads, and despite the bad grammar they may be right.

Turbofonts (continued from page 46)

only lasers on the list are the HP models. For the HP Laseriet Plus there's a library of downloadable characters.

Your new characters can be used as simple substitutes for IBM's-you can access them by number using the Alt key and the number pad, or you can redefine your word processor's keyboard. But you can also use a toggle key to transform the whole keyboard to produce Russian or Greek. A dead-key system allows you to customize mnemonic access to individual characters. The customization procedure is clear, but the inadequate manual makes you figure out the default setup on your own. For total frustration, try the procedure for changing character sets-the program keeps complaining that it can't find files on disks that it never

asked you to insert. You'd do 1 better to start over with a fresh installation. Turbofonts does the job, especially when it | to customize it.

doesn't have to compete with other resident programs, but take a deep breath before trying



Several programs display Greek letters used in scientific notation, but Tutbofonts can print them IBM's Enhanced Color Dis-

Monitors

EGA-compatible monitor. which will display CGA graphics when the EG-19 will not.

Mitsubishi made no attempt at reducing screen glare, which I found to be a real problem. But the EG-19's colors are bright and crisp and rival those of

play, though the white isn't quite as crisp The .31-millimeter dot pitch

matches the Enhancer's, but the brighter Mitsubishi screen makes text easy to read from a bit farther-if you can see past

Compared head to head, the Enhancer's true ECD compatibility, glare-resistant screen. and stylish appearance put it way out in front of the EG-19, though its colors are not quite as good as IBM's. But if all you need is large-scale EGA graphics, either monitor will give you what you want and will likely give your coworkers a

heavy dose of monitor envy as

Do What I Mean, Not What I Sav

"If you're considering an IBMcompatible personal computer, don't be misled by price alone."

alone."

—COMB mail-order catalog ad for Xerox 6064 PC

Dep't of Deja Vu (See Vu, Deja)

From the glossary of Ashton-Tate's Advanced Programmer's Guide for dBASE II and III Plus: Endless Loop. See Loop.

Endless.
Loop, Endless, See Endless
Loop.

Don't Be Misled by The Instructions

Directions for using Rockwell Chemical's CRT cleaner: "Apply to clean, dry surfaces . . ."

On the Skids?

A recent Logitech Inc. advertisement says PC Paintbrush "offers 11 type fonts, a pallet of 16 colors "

Bank on It

"Intel has also announced the 83385 cash controller . . ." —Computer Software News. February 16, 1987

IBM Compatible Kaypro

16, 512K RAM, 360K disk drive, mee hard drive.

portable color card, serial

resista et al. "Visio be et Francis de la constitución de la constituc

Don't be misted by the look and feel: Sweemtakes Marssine

Classified Intelligence

Learn MultiMate Basic: Entre Computer Center conducts a course in Multi-Mate Basic, 9 a.m.-noon, Thursday and Friday, 2929 W. Anderson Lane. Cost is \$175. Call xxx-xxxx. —Austin (Tex.) Ameria-

can Statesman, February 9, 1987 APPLE II+, 48K, Disc

Drive, color monitor, dot metric sprinter, with Apple writer, Only \$995. xxxxxxx. —Battle Creek (Mich.) Enquirer, February 1, & parallel ports, DOS to
1, Basic, Wordstar, Datastar, Calestar, included
all documentation and carrying case, \$1200, xxxxxxx, 9-5.
—The Buffalo News,
February 23, 1987

IBM AT, hard drive, Hayse motem, 1.2 Sloppy, LQ printer. \$3000. Call Chris, xxx-xxxx.

-The Rocky Mountain (Denver) News, January 25, 1987

IBM compatible, special promotion, 1024k turbo, complete with 2 drives, high revolution monitor, clock, ports, \$1397; Hyperion \$699. Computronic, xxx-xxxx.

—Ottawa (Ontario, Canada) Citizen, January 27, 1987 If You Can't. We Can



A sample amortization table in R & R Direct Software's ad for Financial Consultant, an S89 financial calculator program, is off by a factor of 10. It shows \$9,009.69 interest paid in the first month of a 30-year loan on a \$95,000 house (\$900 is more like it).

The headline for the R&R ad says: "With this Financial Consultant you can't make a mistake."

Read samething bizarre about the PC industry? Send entries to Communiqués, PC Manazine. One Park Avenue. New York. NY 10016. Contributors this issue: Charles

Magaine, Ome Park Avenue, New York, New York, New York, And Contributors their insure; Charles Judice (COMB), David Neme (Apple), Dob Dortow (CRT cleaner), Horvey Zabiessi, (entire), Judice (COMB), Neme (Apple), Supple (Codes of Apple), Neme (Apple), N

1987

How to choose an online service













surce is a carefully developed package of online services including electronic mail

computer conferencing, travel services, iness and investing information, Special Interes-sups, electronic bulletin boards, news, weather and sports, education, games, shopping and more.

Be sure you get your money's worth.

This is tough sometimes. Services that advertise that they cost less, can end up costing more. Services that look like they offer everything can be a disappointment when you join and have to pay extra for the services you really wanted. Before you join, find out which

services have surcharges or premium program charges. The Source is one of the few networks that doesn't offer a lot of "a la carte" pricing. We actually charge less for heavily used services like our Special Interest Groups.

What will it cost to learn? After you find a couple of services

Online services make your PC

come alive. But before you

primarily to investors, while

to all people. The Source, on

others are trying to be all things

the other hand, offers a carefully

helpful tips.

it for?

household education.

settle on one, here are some

What are you going to need

Some services cater

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Special Interest Groups that can be used for

business support, personal enjoyment and

that seem to fit your needs, ask about their tutorial offerings. If they don't have any, forget it. Beware of services that offer free connect time without a tutorial. This time gets used up fast and then you're on your own.

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■ PC UPDATE ■ PEGGY GAVAN

Super-dard-combines networking and standatone capabilities with the introduction of Visconia I. I. The new release must om most LANs, including Novell Advanced NetWare, J.Com 3 Plm, BIM PC Netwerk, and 1001 Video Hing, Network, and has standard ing. A single copy of Version I. I. is preed at 5495. A Super-dard-Land-fie, which allows where users to access the great-bleet only in network mode. Is priced at 5495. Registered users of earlier versions can upgrade to other productor for Slova. Doc Computer Associaciales is now subgragal at its software products, including Superciales in Nova Mipping all its software products, including Superciales in Nova Mipping all its software products, including Superciales in Nova Mipping all its software products, including Superciales in Nova Mipping all its software products, including Superciales in Nova Mipping all its software products, including Superciales in Nova Mipping all its software products, including Superciales in Nova Mipping and Super-dard Superdard Super-dard Super-dard Superciales in Nova Mipping and Super-dard Super-dard Superdard Super-dard Super-dard Super-dard Super-dard Superdard Super-dard Super-dard Super-dard Super-dard Superdard Super-dard Super-dard Superdard Super-dard Super-dard Super-dard Super-dard Superdard Super-dard Super-dard Super-dard Super-dard Super-dard Super-dard Super-dard Superdard Super-dard Super-dard Super-dard Super-dard Super-dard Super-dard Superdard Super-dard Super-dard Super-dard Super-dard Super-dard Super-dard Super-dard Superdard Super-dard Super-dard Super-dard Super-dard Super-dard Supe

Intex Solutions has announced a new pricing policy on its X-F-Z products fat work on multiple (more than 12) 7-2-3 or Symphomy specialhetes. Customers can purchase the larger versions of any two X-Y-Z products for \$395 (the original price for one product) or any three for \$395. The small versions, which work with up to 12 worksheets, will continue to retail for \$145 each. Intex Solutions Inc., Wellesley, Mass; (617):431-11603.

EasyLAN, Version 3.0, adds compatibility with NETBIOS, allowing users to run applications programs written to IBM's network interface standard and to develop their own NETBIOS-compatible LAN applications. Single copies of EasyLAN are priced at 599-95. and upgrades are S25 for registered users. A two-PC kit containing two copies and a connecting cable is also available for \$219-95. Server Technolory. Sumovale, Calif. (408) 738-8379.

Brown Bag Software has ceased distribution of the Brown Bag Word Processor with Mail Merge, though it will continue to provide technical support to current users. Brown Bag will direct future orders to Quicksoft, which had licensed portions of its PC-Write code for use in the Brown Bag Word Processor. Quicksoft, Seattle, Wash.; (206) 282-0452.

Toshiba reduced prices on its 24-pin P351 and P351C Model 2 dot matrix printers by \$200 and \$150, respectively. Toshiba America Inc., Irvine, Calif.; (714) 583-3000.

Nashoba Systems' Nutshell flat-file database manager, previously distributed by Leading Edge until taken off the market in August 1986, is available again through CTC of Framigham. Mass. Flos uggested retail price of Nutshell is \$150. Registered users who could not obtain Release 2.0 can upgrade for \$75. For information on Nutshell dearler locations, call (617) 879-7444.



SuperCalc4 now combines networking and stand-alone features in one package. Version 1.1 runs on most LANs and comes with both 3%-brch and 5%-mrh disks. Zenith Data Systems has reduced prices on four of its portable and desking personal computers. The dual-drive Z-148 was reduced \$2000, to \$1,299, and the price of the Z-148 with a 20-megabyte hard disk dropped \$300, to \$1,899, Zenith's Z-248 with a 40-megabyte hard disk dropped \$300, to \$1,899, Zenith's Z-248 with a 40-megabyte hard disk now costs \$4,999, a reduction of \$700, and the Z-171 portable dropped \$400, to \$1,999, Zenith Data Systems, Glenview, III.; (312):391-3860.

Okidata is offering Microline 292 and 293 printer drivers that speed the printing of 1-23 and 293 printer drivers that speed the printing of 1-23 and 297 Driver, contains 11 drivers that provide support of high density 1240- by 144-deepers and 11 drivers that provide support of high density 1240- by 144-deepers and 11 drivers and 11 d



Okidata is offering new buyers of its Microline 292 and 293 printers free printer drivers that enhance 1-2-3 and Symphony graphics.

In brief: Software Publishing Corp. is offering a free conversion disk to current PFS:File owners that allows them to convert their data files to First Choice file folders. Users should contact the company at (415) 962-8910 to obtain the disk...Commodore Business Machines is bundling a free copy of Borland's SideKick with its new 8088-based machines, the PC10-1 and PC10-2. The two machines are priced at \$999 and \$1,199, respectively. Commodore Business Machines Inc., West Chester, Pa.: (215) 431-9100...The latest release of 101 Macros for Lotus 1-2-3 now has 106 macros written in both the 1A version and the 2.0/2.01 versions of 1-2-3. The price of the new release is \$69.95, an increase of \$20; upgrades are \$20 for registered users. Macropac International, Cupertino, Calif.; (408) 996-8143... Wilkinson Software of Westminster. Calif., is offering owners of Eagle Computer systems a hot line number-(714) 895-1759-for technical support, parts, and service... R&R Relational Report Writer, Version 2, has 75 enhancements, including 16 printer fonts that can be specified for fields and text, a report title page, and nine new calculated field functions. The new version also includes Relational Merge, which allows users to prepare form letters directly from related dBASE files. R&R is priced at \$149; upgrades are \$35. Concentric Data Systems Inc... Westboro, Mass.; (617) 366-1122...Scientific Systems has reduced the price of Forecast Master by \$200, to \$595. Scientific Systems, Cambridge, Mass.; (617) 661-6364...ChipSoft has announced a new electronic bulletin board for users of its TurboTax programs. The board, which can be reached by dialing (619) 581-2439, has information on release schedules and the current status of all Turbo-Tax programs. ChipSoft Inc., San Diego, Calif.; (619) 581-2233. Mastersoft has added support for four additional word processor formats to the latest version of its Word For Word document file conversion utility. Version 2.0, priced at \$149, now supports DisplayWrite 3, Microsoft Word, OfficeWriter, and "Smart" ASCII formats. Ungrades are free to registered users. Mastersoft, Phoenix Ariz.; (602) 277-0900.

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How fast is fast?



Despite the technical obstacles and the changing meaning of "fast." everyone wants faster machines. We'll figure out what to do with them later.

rust when you thought your PC AT was pretty quick, along comes a generation of 80286- and 80386-based machines that run twice as fast. Twice as fast is just that-the difference between driving at 55 and 110. The chip manufacturers, meanwhile, are looking forward to clock speeds in the 20- to 24-MHz range, or three times the current 8-MHz standard.

Kid stuff. To be in step with the future, you've got to think in terms of 10, 100, or even 1,000 times faster than the current generation. To do so, we'll have to step beyond today's stodgy processors and look at two emerging technologies, superfast chips and parallel processing.

Silicon has been the semiconductor of choice for building transistors and integrated circuits almost from the beginning. Today's designers, however, are beginning to find the limits of silicon's capabilities. There's a limit to how many transistors you can pack onto one chip and how close together they can be. Much design and engineering effort goes into shrinking the grooves and ridges that define the parts of the transistors. As the features approach | micron (a thousandth of a millimeter). weird things begin to happen. Logic chips don't do what they're supposed to. Tiny lines of metal carrying electrical signals vaporize as the current density exceeds thousands of amps per square inch. The combined heat buildup of thousands of infinitesimal transistors causes meltdown of the entire chip.

A stopgap solution is to build integrated circuits on materials that are better heat conductors or that have electrical characerations. Silicon-on-sapphire (SOS) is as exotic as it sounds. Integrated circuits using this technology are finally available after more than 15 years of research. Siliconon-insulator (SOI) technology is maturing rapidly, too. Both can potentially double the operating speed of today's microprocessors in the next 3 years.

Even the fastest silicon-based technologies can't hold a candle to the incredible speeds being offered by gallium arsenide devices. Gallium is a weird metal that melts in your hand. Arsenic is . . . well, arsenic. Together they make a semiconductor that is ideal for high-speed transistors and integrated circuits.

Recent advances in gallium arsenide (GaAs) technology have pushed the clock speed up to 18 GHz, or over a thousand times faster than the clock speed of today's 80386. Of course, no one has yet built a GaAs circuit that in any way approaches



teristics more conducive to high-speed opthe complexity of an 80386 chip, but they're laying the groundwork. GaAs also promises to be one of the lowest-powerconsumption technologies. This is especially important in avoiding deadly heat buildup in dense chips.

GaAs speeds will force breakthroughs in memory technology, too. Until then, however, we will see more intelligent memory management units (MMUs). The MMU's job is to second-guess the processor and figure out what data and instructions it needs before it needs them. It then moves the required information from slow, cheap memory to fast, expensive memory. Sophisticated statistical techniques make MMUs effective 85 to 99 percent of the time.

Parallel processing is a completely different solution. It is much more complicated-and more elegant-than simply mashing the throttle to the floor. Parallel processor chips are generally designed from scratch to work closely with one another, although Intel has a design that uses multiple 80286 chips.

The key to parallel processing is not so much in the processors themselves, but in the compilers and operating systems. They must understand how to decompose a task, spread it among multiple processors, and assemble their individual efforts into a usable end result.

Parallel processing also gets around a major limitation of faster processors: the response speed of memory and other system components. Rushing data around at 30 MHz is well and good, but chips that can keep pace are very expensive.

■ FROM THE EDITOR'S SCREEN

One of the most talked-about parallel processors available today is Inmos's T414, better known as the Transputer. Each Transputer has a special high-speed communications link solely for interprocessor communications. The Transputer is so fast that it can emulate an 8087 math chip twice as fast as the 8087 can go. without the benefit of dedicated floatingpoint hardware. Inmos has just announced a new version of the Transputer, the T800, with floating-point hardware right on the chip. It promises to be at least 16 times faster than the 8087. The Transputers get faster still when you parallel them.

Emulation is one of the most interesting facets of parallel processors. Through it, software overcomes the wildly different nature of two processors by using one to imitate the other. Historically, emulation is laughably slow. A new generation of chips and compilers has changed that. In fact, the T800 may become the best graphics chip around, simply by imitating today's chips faster than they themselves can operate.

THE COLD FACTS Now let's be utterly realistic and say that the obstacles to using these advanced technologies in PCs are enormous. You can buy a Transputer board that fits into a PC today. You can add up to four more Transputers to it. But your DOS programs have to hand it tasks, let them execute, and collect the results. That's hardly the most efficient way to use parallel processing.

The PC (and AT) bus structure is at least part of the problem. As computer buses go, it's not particularly fast or flexible. I recently saw a new desktop computer with an 8-MHz 80286 and EGA graphics right on the motherboard. The graphics performance was noticeably smoother and faster than what I was used to. Why? Because the chips were talking directly to one another rather than through the PC bus.

Speed is at least part of the reason why IBM has wanted to change the PC bus for some time now. On one hand, it's great to be backward compatible. On the other, we've got to move forward and accept new technologies as they become available.

There is a huge software deficit caused by the embarrassment of riches on the hardware side. It'll be a long time before an end-user system able to harness this power becomes available. It'll be a longer time before applications programs avail themselves of the power. The advent of multitasking operating systems for today's PCs is a good way for software designers to warm up.

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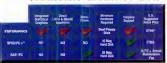
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SUE YOU, SUE ME



Software developers who borrow another's ''look'' are starting to look over their shoulder. It's not the competition they're worried about; it's the lawyers who scare them.

evelopers scream and yell. They moan and groan. Everyone is up in brought on by Lotus against Paperback Software and Mosaic Software for selling Lotus clones.

The issue is over something called "look and feel." The gripers tell me that the lawsuits over software "look and feel" will hurt innovation. When I'm told this I ask: What innovation? Lotus clones and more Lotus clones? Is that innovation? I don't think so.

There is an irony here, too. The reaction of developers to the suit over use of the Lotus user interface has got to be the biggest change in attitude ever accomplished overnight. I hang around with developers and they are always complaining about getting ripped off. Now they are complaining about someone doing something about an alleged rip-off. What a bunch of complaining crybabies!

You can be sure that if the recent laws sail was instigated by some small-times against Lotus for its borrowing an idea or some code, the community would be cheering. With Lotus in the cathieti seat, veryone is complaining, Nobody likes a bully, I guess, and that's the vary Lotus is percived: I suppose there is some justifitus throw Boeing and its Boring Cale into the pot, did you? "Let's not see anyone with money! Let's first some small fry and bleed them." Nice suns.

But we can't ignore the varnish of hypocrisy that coats the grumbling developers. Shaking their collective fists at an un-

seen enemy, they're all saying, "Well, if Lotus wins then I'm going to sue so-and-

Lotus wins then I'm going to sue so-andso." The lawyers' phones are a-ringin'. Calm down, boys. Have a cup of hot cocoa.

DO IT YOURSELF. What will these "look and feel" cases mean? It's apparent that developers will not get away with lifting a user interface or even a screen. This makes cloning harder than before. Then again, maybe not. Borland, for one, sturnbed onto the ultimate solution to the clone issue: its new word processor, Sprint, will have a programmable, do-it-yourself inter-

The developer simply creates a kind of "front-end construction set" that allows you to design your own user interface. If you make it a dead ringer for, say, Word-Star, then that's your business. I can see a book now: Designing a User Interface in the Privacy of Your Own Home.

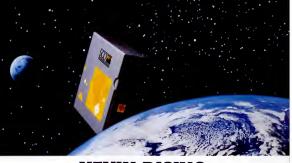
Now the software vendor can legally tell you how to design a front-end that is similar to your favorite, but cannot provide it or encourage you to copy a protected interface. Meanwhile, you can be sure that clone templates will be flying at the user group.

So what the Lotus cloners will have to do if they want to use the Lotus user interface is sell a spreadsheet kernel with a programmable user interface and let the end user turn it into Lotus.

The fammy side of this is that you can be sure that once the user interface is taken out of the hands of developers, the end user will be far more creative than developers ever were. No mere cloning, I don't know about you, but I don't to cerarange things a bit on the Losus screen. Some really creative users may ever been design user interfaces that have never been seen—creating new why not? All the interesting introvation comes from the masses, the users, the creative gove on the state of the company of the co

This means that the Lotus suit may be a boon to creativity, not a road to ruination and a way to stifle incremental development. But who listens to me? Especially when it concerns what seems to be a company that everyone loves to hate: Lotus. We'll watch these cases closely. Personally, I don't care who wins.

The funniest thing about all this is that Paperback Software's lawyers have asked the judge to throw out the suit. The reason? In all this commotion it turns out that Lotus never received an audiovisual copyright for its screens!



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INSIDE TRACK

Politics clouds the future of Windows; PCs outshine the Mac; and a paint program does away with icons.

Windows, Windows. All I hear about is Microsoft Windows. There are jokes about it ("I don't do Windows!") and prognostications ("Windows is the future"), but you still don't see any end users running it.

Moreover, there is a major political problem with Windows among the developers. This was evident at one of our PC Magazine Editors' Days in Los Angeles, where editors get together with developers and marketers to discuss the state of the world.

Here's the Histary (more or less) you hear from the paramoid developers: "Why should we put our program under Windows? We are competing with Microsoft because it publishes applications the microsoft will do a version under Windows that may be able to perform under Mindows that may be able to perform under Mindows that may be able to perform who was the wear of the windows that will do a version under know about. Worse, Microsoft may change Windows so that we'll be unable to update our version and it'll have the content of the windows."

BIL Gates, of course, dender there is any possibility of this happening, son possibility of this happening, any possibility of this happening, our offermately. Gates has told friends the good of this it may be a public statement; that he wants Microsoft "to become the BIM of software." And what's BIM best known for? That's right, tackies similar to the litary described above—putlier to the litary described above—putlier paper BIL should have said he wants be the beautiful to the said was shown to be "the Mother Teress of software." He'd look kind of fanks vin a habit.

What I personally don't like about Windows is the feel of the user interface. I use a Macintosh enough to know what a mouse-based point-and-click interface should feel like. Go play with a Mac and

you'll see what I mean. Windows is clunky by comparison. Very clunky.

When I'm shown Windows, it's the user interface and whiz-bang features that are emphasized. For example, I'm always shown the way the graphical interface can shrink a program and have a miniature screen running in a smallish window. Would someone explain to me

why I'd want to do this? If today's user needs anything, it's true multitasking and a real busting of the 460K barrer. I'm sick and time the half was AUTOENEE BAT and CONFIG.SYS so I can go to my database manager and look something up. Normally, with an on-line thesaurus, cache, and a miscellany of utilities loaded as memory-resident programs or device drivers, I get an "instelland" and the state of the state of the sufficient Memory' message. When

will this lunacy end? Memory is chean. But after reading this diatribe, are we missing the point of Windows? I found that my old friend. Alan Cooper, an exhippie turned super-programmer, has turned into a Moonie for Windows. "I had to be convinced while kicking and screaming," he told me, "Windows isn't a user interface; it's an applications programming interface and that's all it is. It makes it easy for a programmer like me to get his job done without having to reinvent the wheel. The routines available are fantastic and perform well," he says, as he droots over the library of routines he won't have to write, debug, or worry

Forget the user interface; Windows is actually a set of supported software libraries designed to speed software development. Some may say Microsoft wants to turn the world into mental midgets: clones of lazy 68000-type programmers

who hate to code anything complicated and in anything other than C. "Why, I remember back when you were a young whippersnapper that no real man ever wrote in whatcha call your C! It's for wimps. We wrote in assembly language—period! This Windows thingamaile is for wimps. too."

Immediately I wonder why all this help for programmers isn't in the plainvanilla DOS! I ask around and discover that most of the heavy-hitting part of Windows will be in the 386 DOS in some way, shape, or form. We'll see. I'm Windowed out.

Turning Your PC into a Macintosh Dept.: Macintosh users like to show off their machines to the unwary by wowing them with MacPaint, which uses the mouse to doodle on the screen. For some unknown reason, the IBM world doesn't like to emphasize these capabilities. It can be done.

If you want to amaze and delight your friends, then get a Mouse Systems or Microsoft mouse (the bus mouses are the best) for about \$199. Make sure you have an EGA-type graphics card, then buy one of two paint programs that I like a lot. The most popular is PC Paintbrush for \$99 (and PC Paintbrush Plus. \$149). Over 400,000 copies of this thing are in use, so someone is having fun. (Z-Soft, 1950 Spectrum Circle, #A-495. Marietta, GA 30067; (404) 980-1950.) This is like a full-color version of Mac-Paint, with a similar user interface. On an AT, this program is a real attentiongetter. Highly recommended for even the most pompous IBM user.

I also like the Rix Software product, EGA Paint, (Rix Software, 18552 Mac-Arthur Bivd., #470, Irvine, CA 92715; (714) 476-8266.) It uses a totally different interface with windowing for tilke in Microsoft Windows) pop-up menus to select functions. If you hate the Macintosh icon idea, this is the package for you. For 779, It's a real steal.

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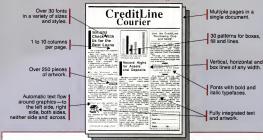
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WHERE E-MAIL SYSTEMS FALL SHORT



Services that ought to be boons to productivity don't quite make it, because the tools to use them are too crude. Lotus's Express is but a start in the right direction.

ommunications software is unquestionably getting better and more sophisticated. ProComm, Relay Gold, and reportedly the new version of Crosstalk are powerful, flexible programs. At the other end of the spectrum, PFS-Arces remains a good choice if your needs are simple—and we may have to drop that qualifier when the inevitable PFS-Professional Access upgrade comes out later this year.

Most interesting of all, though, is Low's new Euperse package. Not just because of its appealing features and style, but because it marks the advent, finally, of a new category of comm software: the dedicated -nail comm package. Howe all those bells and whistles in Relay Gold, for example, when I'm trying to solve a tricky comm problem; but when all I want to do is check my MCI box, they're superfluous.

By contrast, Express recognizes the different needs of the habitual e-mailer. Get and a few other products, such as Transend, have made moves in that direction, but none are fully realized answers to themail sending, checking, reading, and filing needs of that large and growing class of PC users who vecome to rely on a thirdparty e-mail service.

Lous still hasn't given us a good answer to what I think has been the most visible, most infuriating lapse in comm packages: the lack of an easy-to-use, pop-up full-screen editor that's usable while you're on-line, as a refuge from the truly horrible line editors lurking within the e-mail systems.

If you haven't used e-mail much, this column won't make much sense. If you have . . . well, I can tell who you are, because I can hear you banging your tin cups on the table, à la George Raft, shouting, "Better editors! Better editors! Better editors!"

When you're on-line, reading your incoming mail, and find a message that needs a response, you're forced into either of two options. If you can get by with one of those terse, one-or-two-sentence emaily answers, just peck it in, ignore the typos (or hit a couple of x's after mistakes), and send it.

EVERYBODY NEEDS AN EDITOR But if the message you're responding to requires more than just a few words, you'll probably save it to disk, go through the rest of your mail, drop off-line, load your word processor, write the response, save it in plain ASCII form, go back on-line, log on,



type in the recipient's name or account number . . . Whew, Ain't PC productivity grand?

You'll do all that—in the process losing most of the immediacy of e-mail—because trying to write longer messages online will force you, inevitably, into using youre-mail service's on-line editor, which is so bad that it's useless.

But let's say that instead your comm software has a pop-up text editor for those times when you want to write a longer response while you're on-line, then squirt it into the system. Let's say that editor opens a nice horizontal window about 60 characters wide and maybe 12 to 15 lines high.

Within that window you compose your message. And within that text-chiling window you've got three or four levels of relatively shallow (to save on transmission costs) three-character tabs. You be got the PC's usual jump-around keys (PgUp, Home, and End). You're normally in insert mode but can toggle into replace mode.

There are no margin settings, because your text is automatically formatted (with word wrap) into lines no longer than are visible in that 60-character-wide window (which, along with the 12- to 15-line window height, is intended to let enough of that "live" on-line screen show to remind you you're still on-line and the meter is tickine).

When you're finished, you give the message a once-over. You spot a mistake up in the third line; just cursor up and over and fix it. Then with one or two keystrokes you squirt the message out into the e-mail

■ JIM SEYMOUR

system—to which, of course, it appears to have come hot from the keyboard.

The editor is smart enough, of course, to insert hard carriage returns at the end of each of those 60-character-or-shorter lines

as they feed out into the e-mail system, to avoid gagging the system with lines that are too long.

Bingo: your comm software has outsmarted the clowns who built the e-mail

systems' line editors (though to be fair, these make more sense than full-screen editors, which would be shipping characters back and forth endlessly at 300 to 2,400 bits per second to give you that fullscreen freedom).

You can roughly simulate that kind of convenience now by loading a pop-up editor accessory, such as the one in SideKick, along with your comm software. But that's clumsy and lacks the special features, such as hard carriage returns at line ends, you need for e-mailing. That editor ought to be in the communications program.

CALLING SYSTEMS DESIGNERS There's nothing hard about coding and adding that kind of pop-up editor to a comm program. The hard work is in seeing that it's needed, and that doesn't happen until we get enough people who design

■ Trying to write longer messages on-line will force you, inevitably, into using your e-mail service's on-line editor, which is so bad that it's useless

software to use e-mail systems themselves so they'll notice what they'd like to have in such a package.

That's begun to happen, and it's a good part of the reason why we're seeing such mail-fetching packages as Express. A program like Express, which captures everything for a later, off-line reply (but preserves such nice details as auto-addressing of responses), in one sense finesees the need for a decent on-line editor.

But not everyone wants a backgroundfunction auto-fetching e-mail comm program. Many of us will continue to prefer interacting directly—on-line—with e-mail systems. For that we need decent editors built into our comm software.



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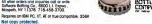
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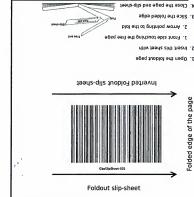
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THE DEATH OF PROGRAMMING?



Dependable BASIC is not quite ready to give up the ghost, it just needs a little nourishment. High-level languages, on the other hand, have something to worry about.

This, as we all are coming to realize, is the year porgramming language will become utterly obsolete. The arrival of manzing tools called applications generators will finally wrest control of computers from the hands of the high priess known as programmers and put power squarely in the hands of users. By asswering a few simple questions, any example of the process of the process

So mark this year well. The year that true user power finally arrives. The year that programmers begin searching frantically for new jobs. The year: nineteen eighty....

Oops. Excuse me. Apparently I opened the wrong file. This one says down at the bottom, "Advance material. Not to be used till next year." I guess I got mixed up because it's dated 1981.

YOU STILL HAVE TO PROGRAM. I'm sure you can understand my confusion. For years now, oracles have routinely as for years now, oracles have routinely as moured the impending demise of programming. But applications generators, while undeniably useful, never quite go all the way. The one that comes with Paradox, for example, ean charm out line after line of useful code. But for certain just-beyond-rudimentary operations (such as automatically generating sequential record how to program, and what you have to program, and what you have to

program in is a tongue you probably didn't learn at your mother's knee: the Paradox Application Language. Time to hit the manuals. PAL.

Final proof that applications generators are it the whole story? We still need programmers to generate them. It's safe, then, to assume that we could still make excellent use of better languages. The way things are going, we're not likely to get them.

At one time, programmers actually encouraged the development of higher-level, more-English-like languages. Now that dise aerons to have been bunished from the realm of general-purpose languages. The thought that someone who hasn't undergone years of training in the "right way" of programming might be able to series something useful seems to fill longtime programmers with nameless dread. I get the feeling that programmers sense that hard languages mean high salaries.



So now C has suddenly become the language of "real programmers," while BA-SIC is considered with the sort of disdain reserved for computer toys. And even the designers of the latest versions of BASIC are doing the things "real" programmers want instead of the things BASIC aficionados want. Microsoft's OuickBASIC and Borland's new Turbo BASIC, for example, offer the ability to abandon line numbers and make the language more structured, more like a "real" language. Nice, but if BASIC programmers wanted a structured programming language, they'd learn one; what they want is a faster, slicker version of what they already know and love.

WHAT'S MISSING What's missing from the new BASICs is twofold: stuff that's already in interpreted BASIC and stuff that BASIC programmers desperately crave. The BASIC interpreter makes it easy to renumber a program in a flash. The new compilers can't do that at all. To renumber, you end up wasting time loading your program into the interpreter. The catch is that once the program gets beyond 64K bytes, the interpreter is off limits.

Now, you might want to renumber your program selectively to define clear regions of code, but the interpreter has never been able to do that. So, naturally, neither can the compilers; apparently the "real" programmers who designed them are so tickled with the idea of deep-sking line numbers altogether that they want to make using them as uncomfortable as possible.

Another thing desperately missing from BASIC is decent technical documentation. ORDER 1-800-426-6659

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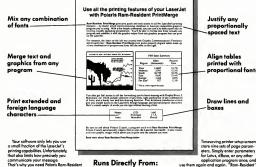
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STEPHEN MANES

About all you get in the way of heavy-duty technical help is a dumb little memory map, so trial and error is the only way to find out what a particular programming practice is likely to mean in terms of speed. size, or memory usage. What's needed is a set of comparative charts of sample routines that says if you use this straight GOTO jump, it'll take up this much memory and work this fast, whereas if you turn it into a GOSUB, it'll work out this way. Do long variable names take up a lot more space than short ones? Is subroutine performance dependent on where the routines are placed within the program? Current documentation doesn't give you a clue.

Worse, there's currently no means of optimizing certain compiler-dependent portions of your program-unless you're an assembly-language programmer. What would be lovely is a BASIC that allowed you to optimize what you need. For example, if screen rewriting was extremely important to you, you could customize the compiler to use superfast screen routines, with the caveat that compatibility might suffer.

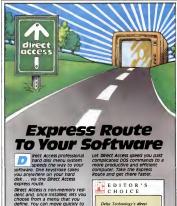
To hear many programmers tell it, BA-SIC is a dead letter. I wonder. Along with virtually every microcomputer jockey, an awful lot of business programmers grew up with BASIC or COBOL, not C. No one would accuse COBOL of being a modem. highly structured language, yet there are probably more programmers who know and use it than any other language except BASIC. Yet C is all that seems to count anymore. And part of the reason is that higher-level languages aren't as flexible or as fast as they ought to be.

It's irritating that programmers always seem to want to keep making things more complicated. Why should we have to program in C and invest in prepackaged subroutine libraries just to clear the screen instead of being able to use an improved version of a more intuitive, more accessible language? The answer seems to lie in the realm of job retention and dogma rather than the realm of possibility.

FORTNIGHTLY FOLLIES Switching gears, a certain new Infocom text adventure offers Tame, Suggestive, and Lewd levels and comes complete with a Scratch 'n' Sniff card. However, IBM PC users with hard disks will discover the dirtiest, stinkiest thing about the program is that its installation procedure wipes out their cherished CONFIG.SYS files without a word of warning.

Infocom's advertising claims "there's room for you on every disk." What it doesn't say is that you have to delete something first.

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1-2-3 AND ME



Having an emotional attachment to the tools of your trade is perfectly normal. But what happens when the object of your affection starts to neglect the relationship?

want to like the companies that publish the software I use. In fact, I think most people want to like the companies that publish the software they use.

This is a funny thing about software. It's no particularly true of hardware, either computer or peripherals, since I just the romputer or work. I want software not only to work but also to come from not only to work but also to come from companies that I like and wouldn't mind working for. Maybe it's because software exists only in some sort of computerized ionosphere, and so it's hard to develop a relationship with a program.

Anyway, this is a long-winded way of introducing what amounts to my second confessional column (I confessed to buying mail-order products some months ago). My confession: I've been having an intense affair for more than 4 years now with Lotus? \$1-2-3.

THE START OF SOMETHING BIG Like any affair, my liaison with 1-2-3 has had many ups and downs. It all started one day (not particularly dark or gloomy) in the basement of Louis's very first building in Cambridge, Massachusetts, in July 1982. Actually, the basement was the company's whole office. Mitch Kapor wanted to show the big of the company of the company of the company's whole office. Mitch Kapor wanted to show the his new program, which he and his coworkers had just named, although he wouldn't tell me what the name was.

I had become involved with personal computers because of VisiCalc, which I had discovered running on an Apple II about a year earlier. I was heavily using that program, since I was ambitiously planning the launch of a new magazine

(never published). Kapor showed me how 1-2-3 used more-complete mems and was more flexible; he demonstrated the features it had that Visicale didn't and they got to the plece de resistance, 1-2-3° ability to graph any part of a worksheet. (Graphs were Kapor's specially. He had just sold his first program, VisiplostVisitrend, to Visicoro for \$1.3 million.

COLLD THIS BE LOVE? After I left, I thought I -2-3 was a near program: exciting, fast on the uptake, fun to be around. But it didn't do must for me at the time because I had an Apple II and I -2-3 ran on an IBM PC. But I liked Kapor, I knew he'd raised a lot of money, and I brought he would probably be successful. (It must have been ESP.)

By the next year, after 1-2-3 had made its debut and was a clear hit, I got a real computer and started using 1-2-3 to plan yet more unpublished magazines and a



newsletter or two. And yes, I fell in love with the program, even though I have yet to use it to graph a single named range. 1-2-3 was fast. Because it ran on the PC, I could build gapaine worksheets. Because 1-2-3 was so endearing, I fell in hove with a wanted to make a difference in its outcomers lives and to treat its employees like early a single program of the program of th

TROUBLE IN PARADISE Then something happened on the way to the bank. Lotus was so successful that it began to believe it knew everything and could do no wrong. Symphony, the company's second program, was introduced in 1984 with much hoopla. When the PC industry and users said it was a poorly designed failure, Lotus acted like it knew better. Jazz, the company's third major program, was introduced in 1985 with even more hoopla. When the industry complained that it was late and users complained that it was slow, Lotus acted as if it couldn't believe anybody would have the gall to criticize a Lotus product.

Meanwhile, 1-2-3 stood still. I began to fall out of low with it. I didn't use the graphing and sorring capabilities. I stooped trying for figure out how to write macros. As word processors and databases out fisser and more capable, 2-2-3's speed began to look less impressive. I started writing tough articles about Lous, criticizing the company for being arrogant and out of touch. This tim for the worse im up per-

■ STEWART ALSOP

sonal feelings toward 1-2-3, however. didn't seem to affect its sales, which continued to grow and grow.

When Lotus finally introduced an improved version of 1-2-3, Release 2.0, in

1985, my feelings about it remained sour. Lotus had managed, first of all, to introduce some remarkable incompatibilities into 1-2-3, forcing users to keep track of which version of the program had pro-

duced each worksheet if a coworker had decided not to upgrade to the new version. More seriously, the company didn't seem to improve the program in any substantial

way. Instead it chose to improve upon what had largely been seen as weaknesses in the program.

Even though such features as linked worksheets, multiple windows, and macro recording were available in competitive products, the new version of my old flame did not have them. Now I was beginning to feel somewhat like a jilted lover, as though 1-2-3 not only looked old but was trying to dump me.

FALLING IN LOVE AGAIN Something marvelous has been happening in the last 6 months. 1-2-3 is beginning to look spry again, and I'm beginning to take a real interest in it and the rest of the Lotus family. Even though the current version of 1-2-3. Release 2.01, is essentially the same as Release 2.0, Lotus has been craftily improving the program's wardrobe. With 1-2-3's new sidekick. Hal. a rambunctious but friendly fellow, it's much easier to talk to 1-2-3 and get it to do things that it wasn't able to do in earlier incarnations. With 1-2-3's sister programs Manuscript and Freelance Plus, it's possible to create reports and other documents that really show off its number-crunching and graphing abilities to other people. With 1-2-3's new add-in programs, it can do a number of things as though it were designed for them. including making faster calculations, processing words, and printing worksheets sideways. And most recently, with its little cousins Metro and Express, 1-2-3 can even do things like take notes, keep track of phone numbers, and call for and send electronic mail, all without bothering me

in the least I'm beginning to think that this is one very exciting program. I'm even beginning to think that Lotus is a hot company again: maybe it isn't as idealistic as it once was, but it certainly has produced a raft of hot products and is treating its customers like real people. Now, if only Lotus would do some serious internal surgery on 1-2-3 and take that nuisance of copy protection off my one true love. I might get so enthusiastic that I'd write a few macros and get another monitor to show off the graphs. 29



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SECURITY STRATEGIES

Hardware Protection for PCs

In a world in which PCs cost hard-earned dollars and data that's taken years to build up can be destroyed in moments, you should consider the hardware alternatives that can keep your machine and your data secure.

s personal computer operations expand and consume an increasing portion of corporate assets, the security of the system and its data is more important than ever. Yet protecting your PC and the data it harbors is like treating a dog with fleas. As soon as you eliminate the problem in one place, it imms to another.

A roundup of hardware security products now on the market, some of white course to the tool to at here, could make the least-suspicious person paranoid about his changio dabout his changio at products currently available are all designed to thwart tamperers, thieves, subteurs, busybodies, mischief-makes, mischief-makes, mischief-makes, mischief-makes, intentionally or unitentionally continued to the within or without, intentionally or unitentionally and its data.

But instead of calming your apprehensions, their number and variety can add to your fear of being ripped off. Unless you assess carefully what you really need and why you need it, as well as what you are getting and from whom, you run the risk of creating additional problems, incurring unnecessary costs, and diminishing your capabilities.

At the same time that security is become ing more essential, the PC battle cry continues to rally the industry around data and machines that users can access, oas risk. When you restrict easy access, you risk user environment. Tightened security can impact the free flow of resources and information and the ease of administering systems. Also, too much security in one place can produce a security gap in another or On the other hand, security that is too the best of the product of the controlled of the control of the controlled of the control of the controlled of

When you're using a PC that sits out in the open, how do you protect the sensitive data that was once relegated to the sacrosanct security-intensive mainframe environment? How do you make sure that you're not putting more obstacles in your way than in the way of tamperers and thieves?

Both software and hardware vendors

COMMONSENSE SECURITY

Practical advice for keeping your PC and data secure.

You don't need any additional hardware or software to take the first steps toward making your PC and your data more secure. Here's a list of data security practices that are good common sense.

. The cardinal rule: If your data is sensitive and you're using a hard disk, don't leave it on the machine. Copy data to a floppy disk and lock it up for safekeeping. But be sure to obliterate the original on your hard disk when you do copy it to a floopy disk. Using the DOS DEL or ERASE commands doesn't wipe out the file; someone with The Norton Utilities, Mace Utilities, or similar programs can easily bring it back to life. Norton's Wipe File program will obliterate every last trace of the file. And so will PC Magazine's DELZ.COM utility (Programming/Utilities, PC Magazine, Volume 4 Number 21). All other rules are secondary to this.

Name sensitive files somewhat repriedly. Instead of calling this year's budget plan BUD87. WKS, try calling it MOM.DOC. And keep a separate printed index somewhere prying eyes can't find it that tells you which files have which innocent-sounding aliases. It's awful to have to guess whether your new budget is called MOM or PICNIC or AP-PILE. PIE or PURPLE COW.

If your software has built-in password protection and/or encryption, use it. For instance, with 1-2-3, Release 2, "File Save File Name P" prompts for a password (twice) and then encrypts the worksheet.

Use existing security devices. If you have a lock on your office door, use it. It

may not be 100 percent burglarproof, but it's certainly a deterrent. If you're really concerned about security, lock your office when you step out. That's when you're especially vulnerable.

 Watch how you dispose of paper printous. They often supply the easiest access to confidential information, especially in offices in which printous are the primary form of backups. And if your printer uses a carbon ribbon, be careful what you do with it when it runs out. It's simple to reconstruct a file by reading the ribbon backwards.

 Be neat—it pays off. Don't tempt fate by leaving floppy disks with your data out in the open. If tamperers and snoops don't get 'em, coffee spills, dust, and fingerprints will. When you leave your desk, no matter how briefly, store floppy disks in a safe place.

"Avoid the obvious and be creative with user IDs and passwords. Tamperers and thieves have been able to get around some perfectly good security schemes because users insisted on using parts of their names or their initials as passwords. Don't tape the password to the bottom of your keyboard.

 Avoid putting sensitive passwords in your communications. If you feel you must script your passwords into your automatic log-on to take full advantage of your communications scripts containing personal passwords when you leave the computer. Some communications programs, like Louis Express, encrypt the password.
 Use special snooperproof disks,

 Use special snooperproof disks, marked with unique physical "fingerprints." No two of these disks have the same fingerprint. A description of the fingerprint is encoded on the disk. When a protected file is accessed, the print and the description are compared to make sure you have an exact match before the decrypted data will be released. (Vault's Filelok is the most popular of this genre.)

• Use your AT lock for its intended purpose. While the lock may be only to-ken security (see accompanying sidebar "Locked Out: The PC AT Lock and Key"), it's better than nothing. Record the key number (not on the hard disk!) and keep a copy in a safe place. And keep a copy in a safe place. And keep to have the present of the key numbers since he is the first person a user turns to if a key is lost.

Consider purchasing removable media such as the Bernoulli Box or other removable hard disks. Some tape and disk combo units provide easy security because the device is external to the PC and tape backups are quick and efficient. (See "Drawing a Bead on Bernoulli," PC Magazine, Volume 6 Number 1.)

• Protect against unintentional destruction: hide or protect your PORMAT command. Versions of DOS later then 2.0 are smarter about avoiding formation of the protect of

have attempted to find the answers to these questions. In this issue we focus on the hardware method and on systems that combine software and hardware—physical devices that protect both your investment and your information. The six devices we look at, examples of the many the

market makes available, include ACCO International's Locking Keyboard Cover, Micro Security Devices' PC Guardian, CVI Laser Corp.'s KBD-Lock, A-O Electronics' X-Lock 100, Jones Futurex's AutoCrypt I, and MPPI's PC Lock IV. But first, consider some of the issues.

HARDWARE SECURITY YIN/YANG Just as the whole issue of taking added security measures has two sides, so does the use of various types of protection. Chaining your PC to the desk or attaching screaming sirens under the hood thwarts outside intruders, but it still leaves the marized access to your hard disk.

« Use Charles Petzold's ATTR program (Programming/Utilities, PC Magazine, Volume 5 Number 11). This, like DOS's ATTRIB program, gives files a read-only status, which problists anyone from making intentional or unintentional alterations. But better than DOS's, ATTR lets users hide files so they don't appear under normal directory searches.

Look for inexpensive software security utilities that offer file protection. PC Magazine* 8 FREEZE program (Programming Utilities, PC Magazine, Volemo 5 Issue 22), written by Jeff Prosise, can help get you stared. It works in RAM to let you suspend a program in midstream, blank your display screen, and lock the computer until you enter a password giving it the go-ahead to resume operations.

 If you're more ambitious, try reassigning some keys in some cryptic fashion. If, for example, you reassign your Enter key to some little-used key, you're bound to throw a ringer to anyone who tries to take a look at your data.

 Be watchful and wary. Know your coworkers and investigate loitering visitors, especially if they appear overly interested in your computer.

 Use extra caution when employees in your area are fired, have resigned, have been laid off, or have quit in a fit of anger. Since resentful employees have been known to destroy data immediately after being fired or laid off, be sure to change the passwords of such saff before they get the bad news, not after, when it may be too late.

. Know what you've got on-disk.

Many word processors create temporary and backup files that are erased after you are done. Yet, as with other DOS files, when these files are erased, they are not erased completely. If you're not careful, someone could use *The Norton Utilities* to unerase them.

 Make sure your printer buffer has been cleared. If you've printed something using a print spooler, and someone knows how, he can come along and reprint what's still in the buffer.

Security is such a big issue that readers are writing to usal flue time with their suggestions. In our User-to-User column, we've published dozens of tips on everything from changing COMting the TYPE command to look at files, to using the PROMIT command to look at files, to using the PROMIT command to look at files, to using the PROMIT command to look at files, to using the PROMIT command to look at files, to using the PROMIT command to look at files, to using the PROMIT command to look at files, to use the promitted to the property of the proting the PROMIT command to look at files, to use the property of the property of the proting the property of the property of the property of the proting the property of the property of the property of the proting the property of the property of the property of the proting the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the property of the property of the proterior of the protection of the property of the proterior of the property of the property of the proterior of the protection of the protection of the protection of the proterior of the protection of the pr

Finally, you should keep these precautionary measures in check with a strong dose of humility and perspective. Your data is probably not as important to others as you may think it is. Industrial secrets are one thing, but even the most secrets are one thing, but even the most to make use of your annual budget, finnancial planning spreadsheer, or goy information to sabetage your efforts. Untess you've working in an environment that is highly secrecy sensitive, you problated to the property of the property of the past use common sense.

-Robin Raskin

chine's data wide open to the prying eyes | boards (and maker of AutoCrypt I, reof a nosy coworker or knowledgeable vinewed here), notes, "Anytone with a
heacher. In addition, even with the compare
or actually bolted to the desk, anyone
condistand or swaji internal boards. Any
boards of the president at lones Future, a manufacture of data security | code data that has been encrypted, he

■ Establishing a rational PC security strategy is a difficult task, partly because it's hard to know what you should protect yourself against.

could modify or obliterate it. And on it goes.

Establishing a rational PC security strategy is a difficult task, partly because it's hard to know what you should protect yourself against. The National Center for Computer Crime Data's recent study of prosecuted computer crime cases found that, contrary to popular belief, there's no stereotypical computer criminal.

With little information to go on, companies don't know exactly what to defend themselves against, and apparently many are losing out. "Many instances of computer crime go unreported," says Jay Bloombecker, the center's director. According to Bloombecker, frequently businesses are reluctant to pursue legal action for a number of reasons, including embarrassing publicity and the cost of taking legal action.

Outright crime is only one of the problems. David Dettloff, product manager at ACCO International, a maker of PC security products (including the Locking Keyboard Cover reviewed here), contends that "about 70 to 80 percent of the damage done to PCs in the office is unintentional and not malicious." A study by International Resource Development, a market research firm, concurs. It found that MIS departments perceive employee revenge as the second greatest threat to data security. second only to users' accidental errors. Bob Nagel, a systems consultant and designer of PC Accessories, reports that casual tampering, including the swapping of

PC boards by coworkers, is on the rise.

■ SECURITY STRATEGIES

Office environments in which PCs are the common property of a group of users create additional security concerns. And although you may not be worried about security, your most important customers may be. If you dead with some branches of the government or even if you're subcontracting to security-conscious private firms, your customers may insist that you use some type of data security system.

In response to the need for tightened security in many offices, new products are proliferating to meet the attack. Inmuc, a California-based leading supplier of computer products to corporations, has tripled its security product offerings over the last 12 months. "Without equivocation," says Immac's John Erb, "we're finding an increased awareness of security issues from our buyers."

LOCKS: LOW-COST SOLUTIONS At their most basic level, hardware devices to deter physical tampering take the form of locks. Everyone understands their message: Private property. No trespassing.

Locks require minimal installation and are inexpensive, usually costing from \$20 to \$100. PC Accessories' Nagel enthusiastically cites the benefits of these devices: "They don't interfere; there are no passwords to memorize, no boards to install, and no memory chewed up by software; and the price is right."

Locking the PC provides a good measure of protection from the professional thief or the casual meddler—which one depends on where you decide to put the lock. You can find a device that locks your PC's keyboard, onloff switch, backplate, or cover screw or one that locks your PC itself to the desk, floor, or any other permanent fixture.

Unobtrusive keyboard covers with locks climinate the possibility of someone's secidentally or intentionally hitting a key. Other keyboard variations statish to the keyboard ping and let your workstation keep running while the keyboard remains locked. A lock creasing the computer's your PC. A lock on the backplate or cover serw of the PC chassis prevents underthe-hoad access. Some of these locks are sold as combination units, offering protection at multiple opints. Businesses can never fully protect their
 PCs from theft. But they can make it more

difficult for thieves to

IMMOVABLE OBJECTS Where the flow of human traffic is heavy, a number of organizations have begun to incorporate physical security as a routine part of every computer installation. At Amoc's 80-story office building in Chicago, each PC is routinely outfitted with steel-cable devices and sirens.

A recently built public-access computer la facility at New York's Columbia University incorporates a high-tech, highly tempergoof classing. Steel burs and caschardened locks protect the CPUs. Monitors are cemented to the desks with spacage adhesives. This elaborate security effort, according to Columbia's Frank da Cruz, "San't a backlash to any inordinate the control of the CPUs. Monitor of the CPUs of the CPUs

Houghton-Mifflin has adopted a preventive approach to security. The publishing company has housed its newly acquired PC ATs in locked steel castings and permanently affixed them to steel carts as an antitheft tactic. "It's a start of a trend we will continue with other new purchases," says Audrey Whitfield of the Business Software Division.

Since anyone with enough time and energy can find a way to defeat even the best security system, businesses and other organizations can never fully protect their PCs from theft. But they can make it more difficult for thirevs to succeed. The idea is to make stealing the equipment so troublesome that the tine will decide to go next door where the pickings are easier. Other obviscal lock mechanisms fend off an array of less criminal but equally serious activity associated with equipment that 5 located in a publis-access area. AC-that 5 located in a publis-access area. AC-that 5 located in a publis-access area. AC-that 5 located in a publish of the office cleaning person who thoughtfully shat of the PC-AT server, destroying the data of those connected to it. The company forthwith installed a \$30 lock on the power switch to eliminate future catastrophes.

Board swapping is the next wave in nonmalicious tampering. Coveting thy neighbor's board enough to do something about it has become quite popular. It's not uncommon for "Joe to be sitting next to Frank and decide that Frank doesn't need that fancy display card as much as he does," observes Nagel of PC Accessories. "Joe then pops off the cover and helps himself." Similarly, an employee may decide that his home computer needs the company's memory expansion card more than the office computer. The best protection against board swapping, tampering, and messing under the hood are locks for the cover screw or backplate of the PC.

Despite the variety of products, some companies are reluctant to lock up the goods. Lack of a corporate security program seems to be a major dostacle. One New York bank vice president I spoke with feels that security is viewed as non-productive work, and so it's relegated to being a low priority. He confided that his bank did not have a comprehensive PC security policy and that it probably would muilt "the first unpleasant occurrence."

Rick Koenig of the Computer Security Institute, a Massachusetts-based clearinghouse for security professionals, compared security measures to backing up your data: "You believe in the procedure only after you've lost a couple of files."

Some people are also leery of making the PC look like a prisoner on a chain gang. Unsightly locks and padlocks can be psychologically disturbing. According to Imma's Eth., attractive cabinets with built-in locks are preferred over bulky cabing Most of the locking-device manufacturers appear to be doing their utmost to give their installed products a low profile.

PROTECTING DATA Protecting the physical machine is certainly important, but in most cases the stored information is

The Invaders (The Forces of Evil)

The Corporate Spy

The sama our who tried to jimmy your file cabinet may now be after your electronic data. While espinnane tends to target the trade secrets, certain PC areas such as fibookkeaping ara likely tai gets for professional snoops





Physical Locks Make the massage clear:

The Protectors (The Forces of Boad)



ENTER YOUR

don't mass around here! 1. Lock the door to your office. 2, bolt the machina to the ground to protect your financial investment, and/or

The Hacker

it's the hackers who have the stick-to-stiveness to keep on trying until a system is penatrated Some relish decoding the ultimate encryption scheme others plant under lacted Trojan horsas in working programs, and others pany EGA because it'll do wonders for their clone at



Access Control

Who goas thera? Identify yoursalt!" is the battla cry of access control If you need to astablish who can use the computer, force users to identify themsalvas to the computer and limit users to certain authorized areas once thay are identified. Hardware and

softwara access controls

The Innocent Incompetent Hard disks and a mysterious

DOS anvironment make navigating the PC waters tough going for the uninitiated. An accidental disk format, a copy ing but different file, and a file wipeout are all potential dangers

The Unhappy Employee

A racent survey indicated that

more computer crime is com-

mitted by insiders than by

tivation, was only slightly

shead of maliciousness and

outside hackers, Ignorance,

listed as the number-one mo-



A Mighty Fortress Is Our Computer?

What are you trying to protect and from whom? As the processing power of the PC increases, so does the sensitive nature of data stored on it. The old mainframe security procedures: lock down, log on, restrict access, and encrypt are back to haunt PC users who thought that personal meant "free from security concerns." Hardware security devices offer a variety of barricades against the forces that intentionally or unintentionally invade your office.



Encryption Make the intalligible

unintelligible 5. Even if you intarcept this data, you need a special kay in order for it to make sanse. Hardware ancryption tands to ba fast. It's more protective but also more expensiva than its softwara counterpart.



Offica crime was, is, and will always be a problem. Unp tected, out-in-tha-open PCs are a thief's wish come true



Data Integrity How much confidence do you hava in your PC data? Hardwara security systems can incorporate accountability and auditability tracking

LOCKED OUT: THE PC AT LOCK AND KEY

The PC AT lock offers good data protection, but for some reason PC AT owners tuck the keys away rather than lock up their machines.

When PC Magazine first reviewed the AT, executive editor Paul Somerson predicted ("IBM Brings Out the Big Guns." PC Magazine, Volume 3) Number 22) his the AT Key lock would become a high-tech stasus symbol, worn ornamentally around the neck. During the auspicious AT debut, glossy photos showed the AT Key dangling seductively

from the AT lock.

The AT lock sits prominently on the front panel of the machine. You can remove the AT key from the lock in either the locked or the unlocked position. When locked, the AT cannot be booted. Furthermore, you can't (easily) remove

the system unit cover.

When it was first introduced, the AT lock represented a new dimension; it meant that the PC could handle the security needs, as well as the high-speed processing needs, of corporate users. Yet a few years later, most AT locks have atrophied from disuse.

User perceptions are to blame. It seems the user is more paranoid about losing the key than about losing the data. Informal surveys indicate that the AT lock has become primarily decorative, with most keys tucked away—out of sight and out of mind.

The disappearance of the keys is strange because the AT lock actually affords a good bit of built-in data protection. Somerson wrote optimistically about life before and after locks. "It's possible [before the AT]," he said, "for an interloper with a nut driver to snap off the cover, twist out the hard disk, and walk through the front door with all your firm's sensitive files under his arm. To the security guard, it's just a can with a few wires hanging out; to you it's your job, your whole future, down the sewer. But not with the AT. To pry the cover off, you need the sinews of Arnold Schwartzenegger and a crowbar the size

of your leg."

The AT lock and key are made by Chicago Lock Co. The circular design was originally developed by CLC founder Lyle Schinn in 1934. It's the same lock you find on vending and pinball machines. The lock design is superior.

or to many others because it has more variations and is more difficult to duplicate than conventional locks. In addition, the lock's "shallow" size doesn't interes with the AT internals. The lock trails two wires attached to the PC mother-board, which sense the position of the lock.

Obviously the lock protects your AT from casual, unintentional, and normalicious interference. The lock keeps out basically honest folks with inquisitive fingers, but the brutes truly dedicated to getting into a machine will not be hindered. It's common knowledge that if you pry the cover off the machine, you can easily hot-wire the PC and bypass the lock.

Locking yourself out is an important concern though. "I think people are basically afraid of losing the key," says PC Magazine contributing editor Charles Petzold. "If you drive a car, you know that if you leave the keys inside you can open the door with a clothes hanger. If you live in an apartment, you know that if you lose you rkey, you can get a lock-

perceived as being even more valuable. The American Institute of Physics (AIP) in New York has offices in its own building with its own security and receptionist side their to tumpering. But he, AIP has a manner of users sharing a PC, so instant data security and confidentiality are among the issues that in has addressed. At Shell Offshore's New Orleans office, Kervin Powell feels that building visitors as a country of the AIP has a security badge restrictions are assistancely, via Powell feels that building visitors as executive badge restrictions are assistancely, and the AIP with the AIP with

How can you lock your data if you're more worried about losing it than your PCs? An add-on board security device provides a means of protecting your data's confidentiality and integrity. These devices protect access to restricted information, prevent unauthorized use, and often provide an audit trail.

Although installing this type of hardware requires a much greater level of sophistication than sticking a lock or boil to make the Codes, the benefits are many, capegorisms that perform the same functions. Utilities offware, hardware—none you've installed it—requires little participation on you. Hardware is fast. The boards from you. Hardware is fast. The boards have been supported in the participation of the participation of

Hardware can offer more-complex protection. As evidenced by the trail of broken copy-protection schemes, most software

publishers are reluctant to use more than token out-and-back protection systems to check for unauthorized use. The more complex the software protection scheme, the more likely it is to interfere with the

Hardware is harder to violate than software. Even if the software protection schemes prohibit you from viewing data, you can seriously mess things up by simple tampering. Disks by their very nature are readable and writeable—hence susceptibe. "The ability to reformat and erase data easily is the Achilles' heel of software." says Amoo's Jesse Hernandez.

Hardware is so crucial to secure data absolutely that the National Bureau of standards insists that the data encryption algorithm (DEA) be on a chip to comply with its rigorous specifications. You simsmith to come. But the key for the AT looks so funny that people are afraid if they lose it they won't be able to use their machines again."

Since corporate mandates concerning the lock are few, the decision to lock or not to lock becomes an individual one. Some think the risk is worth it, they lock their machines. Others pretend the lock doesn't exist. If you weigh the protection offered against the risk of playing with locks, you may put the keys away, deciding it's safer not to use them.

What happens if you do love the key. When you get your AT, you receive a plastic bag containing two keys and and tag with a number on it. You also get the phone number of Chicago Lock, which you can call to request a duplicate key—if you have the tag number. When Lealled BHM to find out where I might go for duplicate keys in the event that I lost may tag number, a helpful IBM spokes-person scrounged around the company vaults to unearth the Personal Computer Family Service Information Manual, which specifically states that duplicate which specifically states that duplicate the property of the control of the control

keys are the responsibility of the customer. IBM apparently doesn't keep records of lock numbers linked to AT serial numbers. Undaunted, I called Chicago Lock and learned that I could secure duplicate keys—if I had the key number. Lose the number and you're at the mercy of a locksmith.

So it's no wonder many people are nervous or skeptical about the lock. It's come to be generally perceived as a mainment that offers intel protection. In fact, hardware reviewers barely note the present the protection of the present part of the part of the present part of the part of t

More important, the AT lock is actually a functioning lock. One reviewer told me about a clone with a "lock to nowhere." The "AT look" was achieved with a fake lock — Rohin Raskin

ply can't change chips as easily as you can software memory.

Most of the hardware data security

products available are hybrids that combine a number of different protection mechanisms to provide security on a number of fronts. The three basic types are encryption, access control, and auditing.

ENCRYPTING DATA One of the most obvious ways to protect confidential data is to encrypt it so that it is unimelligible to anyone who might try to access it. You can use hardware or software to encrypt data, but the preferred method if you have highly sensitive data is to use hardware. Encryption software is vulnerable to the expert tacker who can enter the encrypt program, modify the code, and put a file into a permanent state of gibberish.

Algorithms built into a chip and coupled with other antitampering devices are more effective against such tampering. A chip may be protected and booby-trapped, for example, so that if anyone tries to fiddle with it, it becomes completely unreadable. This eliminates the possibility of a knowledgeable hacker slipping a "skele-

too key" into your encryption program. If a hardware system requires passwords, the passwords themselves are entered into PROM or EPROM chips, which are designed to become inoperative if tampered with. Boards can also be designed to fail, or to lock up the computer, if they are moved from one computer to another. That way the thief or tamperer work to able to sneak a board off the ortemises for

decoding.

Most software programs encrypt your

file after you've written it. Some hardware also encrypts on a file level, but because encryption on chips take so little time, they can encrypt and decrypt "on the fly. With this system, every time your program writes to disk, the data is automatically encrypted, and every time it reads from disk. the data is decrypted. This method is obviously more secure than writing a normal file out to disk, encrypting it, and then decrypting the whole thing when you want to work on it. With integral encryption, the only time the data is in readable form is when it's in your computer's memory. providing an efficient but transparent encryption mechanism. Yet the determined perpetrator could use a memory-resident Trojan horse to make a copy of the PC's memory, thereby bypassing the encrypted disk file.

Encryption algorithms come in two basic styles: DSC (Data Encryption Standard), which is the standard published by the U.S. government and repeatedly tested by the National Bureau of Standards, and proprietary algorithms, which are developed by the manufacturer or other party. Proprietary algorithms tend to be less expensive than the DES chip, and they often run faster, but DES is the way to go if you want the recoprized standard.

CONTROLLING ACCESS Ideally you should have a system in place for essuring and a control of the c

ality, but y jumps are projections constitution of the projection of the projection



sensitive data



Unauthorized access to PC's costs organizations untold millions of dollars every year.

The Intra-lock** plug-in PC board is the most secure and versatile solution to data security available today, Intra-lock** is currently available for IBM PC, XT, AT* and IBM compatible systems. Intra-lock** works equally well in stand-alone and network environments.

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X-LOCK 100

BM In. arts con-mation integrity by restricting compute access only to authorized users and by encrypting and "hiding" selected files. The X-LOCK 100 also provides a usage pement system that tracks computer ces and time it is clear for project

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X-LOCK 50

The X-LOCK 50 is an inexpensive "security only" version of the X-LOCK 100. Consisting of a plug-in module and software dislette, the X-LOCK 50 provide up to 160 authorized user accounts which are controlled by a single "super-

user." Each user's password is encrypted and stand in battery backed up RAM on the X-LOCK 50. The X-LOCK 50 also pro-vides DES encryption for files or entire

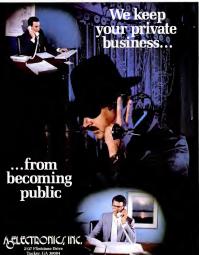
GTX-100 The GTX-100 is an intelligent modern designed to protect unauthorized com-puter access from remote sites. It features dial-back verification from a list of pre-authorized telephone numbers as well as password access. The GTX 100 is in as password access. The GIA 100 is impatible with all major computer stems prohibiting unauthorized access fill the caller's location and password we been verified. Major features of the

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GTX-100R

The GTX-100R provides the same securificatures as the GTX-100 plus the ability to remotely power a computer on or a The GTX-100R's "remote-on" feature ws a caller to turn a system on from where—provided the dial-back and sword security tests have been passes The remote on feature provides acided bility and eliminates the risk of a

- thy who might be tempted to



Voice Security

MDSS

MDSS is a multi-dimensional voice security technology designed for a wir range of applications. Using both simular frequency scrambling, MDSS reducte intelligibility of transmitted sounds. the interiography of transmitted souther and reconstructs them at the receiving and. This helps eliminate the possibilith that confidential information can be or heard by exvestroppers. MOSS technoli-can be used in a wide range of voice receivity, employed production.

ASLECTBONKS INC.

CVAS-III

OAS III is the state of the art is voice security Based on digital signal processing, OAS-II is the most securit telephone system available lodge, All sounds encrysted by OAS-II are turned into "white noise," set the reconstructed voice is clear and free from disortion. OAS-III occurs believe systems are losed for secure telephone systems are losed for

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CIRCLE 390 ON READER SERVICE CARD

machine during boot-up and post-process to identify the user. Typically, the ROM on the boards contains some nonvolatile read-write memory that can store ID apsassword information. If the board is satisfied with the password in from its satisfied with the password in from its usually bank to DOS. If not, it usually shuts down the machine; many of the boards also store a record of the attempted entires.

Even after you've proved that you're an authorized user, the system can restrict your access to certain file areas. For example, at the American Institute of Physics, users are allowed only restricted access to payroll and personnel files.

Many access control mechanisms use implicit file encryption. If you ask for a file but you can't offer the password to decrypt it, then you can't see it. Others work by associating a user ID with a list of files, di-

rectories, or subdirectories.

Some products offer greater control by restricting access to peripheral devices on the basis of their predetermined for the basis of their predetermined such Clarence Williams, of A.O Electronies, (makers of X-Lock 100, reviewed here), notes that this restriction, combined with access control, prevents the disguntled employee who 's just been fired from spending his last days on the job principal inordinate amounts of your company's proportiest wateries.

Stream of Standards Stream of Standards Stream of Stream

Those with more-sensitive data may opt to restrict on a file-by-file basis; doing so requires more system administration, often by a "superuser." Implicit in any restriction of PC territory is the notion of such a superuser, endowed with superpowers, who can make and modify assignments. "The trick," says Amoco's Hernandez, "is to specify access with minimal impact on productivity."

■ The next frontier in protection will address the issues raised by multitasking, multiprogramming environments

AUDITING When the superuser sets up accounts, passwords, and restrictions, he can also use audit capabilities, supplied by hardware security devices, to monitor usage. Auditing hardware devices store records of usage in their RAM. Users can recall this information for use as the basis for report generation and invoicing.

SHARED INFORMATION The next frontier in protection will address the issues raised by multitasking, multiprogramming environments. "Physical devices are stopgap measures," says Computer Security Institute's Koenig, "more suitable where the number of PCs is small and the assets of the information you are trying to protect are identifiable. As computers proliferate and connect into each other, the security and ownership issues grow more complex." Koenig, who lectures frequently on the topic of security, postulates the evolution of a more comprehensive information management approach, which is emerging with some new hardware products.

Currently a few products restrict access to the network from any node. But it seems that for the most part organizations are still running these devices through experimental paces. Until the products are proven to be effective, companies are reluctant to keep extremely confidential data stored on a PC, and that goes double when the PC is on a network.

Shared data also requires secure communications. To be secure, data transmitted via modern must be encrypted and decrypted as it enters and leaves a telephone network. Hardware products that can power up a PC from a remote location and also offer callback verification and password protection are being incorporated in the communications environment.

KEEPING IT SIMPLE "We've come full circle," asserts Bob Petrie, vice president at Manufacturers Hanover Trust. "Superusers, log-ons, IDs—these are all mainframe security measures that have migrated to the PC level. The concept of the PC as a mini data center is the concept we need to self to the user."

Yet the old-line mainframe approach to security is less than satisfactory. As Amoco's Hernandez reminds us, "The mainframe approach can detract from the objective of using the PC."

Strinuser, of the National Bureau of Stundardsr, risses an important issue: devices like security boards often change the way things on your PC operate. Thus when you're trying to restrict access to the computer at the board level, you may find yourself restricted in ways you hadn't anticipated. As Seimaner notes, "Security devices can make two types of errors: first, devices can make two types of errors. Irist, allowing an unathorized user to get in. By trying to minimize the second, these devices inadvertedly maximize the first."

So the biggest problem with security devices appears to be not in implementing features but in keeping the products simple. "If the device is hard to use and bogs users down, they'll be reluctant to use it at all." says MPPi's Clark.

Hemandez advises that companies attempt to reconcile the benefits of the PC environment with a secure environment, and in recommending products and security measures, he tries to "preserve the beauty of using the PC by trying to minimize the administrative overhead that accompanies security measures.

comparison to the control of the products reviewed here, you'll want to ask yourself and your company some questions, beginning with: What do we need to secure? What hazards do we need to secure if from?

--- Pohin Packin

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Options for protecting your PC and the data stored on it one varied. Solutions range from the simple to the explaint cost of, some sores out for the physical practicals on lock to cores, which there require the added lanurous of diston exercision (1) The Leving Rechard Cores from ACCO International, (2) MPF; PC Lev N. (3) A-O Electronics X-Lev A (0), (4) The RBD-Lev k from CV Lacer Corp. (5) The 304 board and software them takes placen Founces A (which was also placed from the physical founces and the control of the size of the

ACCO INTERNATIONAL INC. Locking Keyboard Cover

The ACCO International Locking Keyboard Cover is exactly that—a \$24.95 plastic cover that hooks over your keyboard and lock. Locking covers for your keyboard like this one offer security at its most basic.

Despite their simplicity, such locking covers can be very valuable to the operator whose machine is working on a big silent job—a super sort operation, for example. Locking up the keyboard prevents a worker with wandering fingers from messing up the job when it's left unattended.

Security measures need not be complex, rather they should be designed to meet the threat. If a wayward keyboarder is a threat, the ACCO keyboard cover is a good, inexpensive solution.

-Richard Aarons

A-O ELECTRONICS INC. X-Lock 100

The X-Lock 100 hardware/software system, from A-O Electronics, has three main components: a printed circuit controller board, a floppy disk with security management software, and a locking device that replaces one of the computer's cover screws, thus preventing access to the installed board. The board has a coin cell battery that is mounted in a plastic holder; it helps maintain on-board memory storage. An onboard microprocessor maintains up to 72

board microprocessor maintains up to 72 individual user accounts.

System security is provided through the

use of passwords (access codes). X-Lock 100 monitors assigned codes to allow access to the system and also maintains a full record of activity by code.

X-Lock 100 creates accounts (users) by limiting access to the hard disk(s) or printer(s) attached to the computer. A user logs on by entering a valid access code. X-Lock 100 then allows him to use the equipment.

The X-Lock 100 card operates in the background and is thus invisible to the

■ SECURITY STRATEGIES

user. It times his activities and prevents him from accessing a disk or printer he is not qualified to use. It also records (for the system manager's eyes only) any attempts the user makes to access a disallowed de-

Because some hackers know how to bypass a DOS lockout, the \$495 X-Lock 100 system will shut down the system if someone attempts to access a locked-out drive.

With 5.07 × 1036 possible access codes available, it is unlikely that users will be able to guess the codes. X-Lock 100 prevents scanning by shutting the system down if a user or users enter five incorrect codes in a row. (This feature makes password search programs completely use-

less.) This sophisticated, compact, easy-tomanage system is completely secure as long as the X-Lock 100 card is in place. It provides protection only at the device level, but that is often precisely what is needed.-Richard Aarons

CVI LASER CORP.

KBD-Lock

The KBD-Lock kit, \$9.95 to \$64.95 from CVI Laser Corp., is an electromechanical key-and-lock system similar to the one provided as standard equipment on the IBM PC AT. With the KBD-Lock in place, you use a key to turn a rear-mounted cylinder lock to the on or off position. The cylinder lock is actually a switch that opens or closes the keyboard circuit.

The system also sounds an alarm whenever someone hits a key on the keyboard while the lock is in the protect position and the system unit is on. Installing the lock takes about 5 minutes, but it does require some knowledge of the insides of the machine.

If you've always envied the lock and key on the AT (see sidebar "Locked Out: The PC AT Lock and Key"), you'll want to investigate the KBD-Lock. -Richard Agrons

JONES FUTUREX INC.

AutoCrypt I AutoCrypt I, from Jones Futurex, is a so-

phisticated auto-encryption system that works in the background. It offers the system manager many features to meet the



FACT FILE

AutoCryp1 I Jones Futurex Inc 3079 Kileore Rd.

Rancho Cordova, CA 95670 List Price: \$690

Requires: IBM PC, PC-XT, PC AT, or compatible

In Short: A hardware and software data-encryption system that is managed by a system administrator who assigns passwords and grants multiple levels of access to users. CHOLE 676 ON READER SERVICE CARD

KBD-Lock

CVI Laser Corn 200 Dorado Pl. SE Albuquerque, NM 87123

(505) 296-9541 List Price: \$49.95 to \$64.95

Requires: IBM PC or PC-XT; Compaq Deskpro; or AT&TPC In Short: An electromec

lock system similar to the lock found on the IBM PC AT CIRCLE 676 ON READER SERVICE CARD

Locking Keyboard Cover ACCO International Inc. 770 S. ACCO Plaza Wheeling, IL 60090

needs of special security situations.

ing with the encryption circuitry.

(312) 541-9500 List Price: \$24.95 In Short: A simple solution that prevents anyone from tampering with your data

through restricting access to your keyboard. It's designed for IBM PC, PC-XT, PC AT, and compatibles OFICE 600 EN READER SERVICE CAR

PC Guardian Micro Security Devices Inc

1414 Lincoln Avenue, #104 San Rafael, CA 94901 (415) 459,0190

List Price: \$49.95

Requires: IBM PC, PC-XT, PC AT, or compatibles with mechanically identical system units

In Short: A simple, inexpensive locking device that fits over your PC's power switch to make sure no one tampers with your system CIPCLE 676 ON READER SERVICE CARD

PC Lock IV

MPPi Ltd 2200 Lehigh Ave Glenview, IL 60025

(312) 998-8400 List Price: \$299: \$499 with DES encryption

Requires: IBM PC, PC-XT, PC AT, or most cummatibles

In Short: A data-encryption system that not only encrypts data but also logs user access and illegal access attempts CIRCLE 675 ON READER SERVICE CAR

X-Lock 100 A-O Electronics Inc. 2137 Elintetone De

Tucker, GA 30084 (404) 401-8044

List Price: \$495 Requires: IBM PC, PC-XT, PC AT, or

compatible; one empty slot: 192K RAM to In Short: A hardware/software security system that uses access codes and user accounts giving you protection at the device level. S 677 ON READER SERVICE CARD

(\$690) but highly flexible and sophisticated security system. If your security challenges are complex and serious, you'll want to consider this system.

The heart of the AutoCrypt system is a printed circuit board providing hardwareimplemented Data Encryption Standard (DES) data security (government-grade -Richard Agrons protection). The board is available with a

steel cover to prevent unauthorized tinker-AutoCrypt I software uses the encryption circuitry to provide multiple levels of access to users, depending on privileges that the system manager grants. Basically, the system manager assigns users key phrases (passwords) and access levels

MICRO SECURITY DEVICES INC. PC Guardian

The challenge to PC security is sometimes relatively basic. In a school, for example, the real security job might be at best to keep the kids from using the machines when the teacher is out and, at worst, to keep the little loves from walking out the

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- FCC Approved

FOR SERIOUS READERS: A SECURITY READING LIST

Jones Futurex of Rancho Cordova, J California, the maker of the sophisticated AutoCypt device and other security systems, gives its customers a list of recommended readings. If you're concerned about PC data security, you'll want to oder some of these useful publications are available from the Government Printing Office or the Clearingbouse for Schingoli, which is the contraction of the co

entific and Technical Documents.)

• Data Security Through Cryptography,
IBM Form No. GC22-9062 (systems). It describes cryptography and its role in the data security of a system installation.

• IBM Cryptographic Subsystems Con-

BM Cryptographic Subsystems Concepts and Facilities, 1BM Form No. GC22-9063-3 (systems). It describes the

IBM cryptographic subsystems.

• ANSI (American National Standards Institute) X3.92-1981: "American Na-

Institute) X3.92-1981: "American National Standard Data Encryption Algorithm."

• ANSI X3.106-1983: "American Na-

ANSI X.3.106-1983; "American National Standard for Information Systems—Data Encryption Algorithm—Modes of Operation."
 FIPS PUB #46 (Federal Information

Processing Standards Publication 46): "Data Encryption Standard" (category: ADP operations; subcategory: computer security), April 1981.
• FIPS PUB #81: "DES Modes of Operations of Ope

ation" (category: ADP Operations; subcategory: computer security), December 1980.—Richard Aarons

door with the machine when everybody's out. Micro Security Devices offers a solution: PC Guardian, a locking steel cover that fits over the power switch.

While the keyboard locks that appear system, all user

on the AT and on many AT clones prevent unauthorized keyboard operations, they do not prevent someone from manipulating the master power switch or transporting the machine without authorization.

Inexpensive mechanical locking device and the property of the property of the protice and the property of the property of the protice and property of the proper

MPPILTD. PC Lock IV

MPPi makes a series of controller board/software encryption systems using either the Data Encryption Standard (DES) (\$99) or its own proprietary (\$299) standard. Its PC Lock IV system not only encrypts data, but it also logs user access and illegal access attempts.

In this system, all users may encrypt all

■ With the PC Lock IV system, all users may encrypt all files on a file-by-file basis.

files on a file-by-file basis. The system manager controls all the encryption keys. PC Lock IV implements user access

PC Lock IV implements user access and controls at several levels, including system (boot), directory/subdirectory, file copy, and command (copy, rename, erase, or delete subdirectory or file).

MPPi systems like PC Lock IV are reasonably priced, highly sophisticated security/encryption systems. They are intended for serious users with serious security applications. MPPi will also help you find special solutions for your individual security problems.—Richard Aarons

Richard Aarons is a contributing editor of PC Magazine. Robin Raskin is a frequent contributor to PC Magazine.

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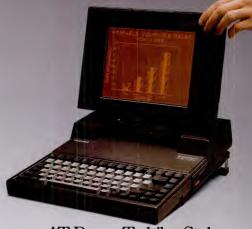
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TECHNOLOGY

Great Performance for Under \$3,000

New, low-cost laser printers are challenging the HP dynasty, which has countered with an impressive new entry. Supporting products are flooding the laser market: printer-sharing devices, multiple-bin sheet feeders, and a slew of hardware and software enhancements. This article looks at five low-cost lasers and as supporting products for both old and

new lasers.

chuuup. 1sk. Schuuup. 1sk. Schuuup. 1sk. Schuuup. 1sk. That odd, trademark-like whisper of desktop laser printers has replaced the Galling gun rati-a-tat of daisy wheels and the grating whine of dot matris printers in many offices. Now new, lower-priced, more-compact laser printers

are moving more lasers into more offices. This issue looks at the laser market's new printers and supporting products to enhance the older printers. In the reviews that follow in this article, HP Lasersjet gun Alfred Poor takes a look at the new, lowpriced challengers: the Epson GQ-3500, the Okidata Laserline 6, the QMS Big Kiss, and the Ricch PC Laser 600. Also, Deep Magazine Editor Bill Machrone rejet Series II. Other companies, such as jet Series II. Other companies, such as NEC, are also manufacturing laser printers for under \$3,000. They will be reviewed in upcoming issues.

Phil Wiswell, yet another member of PC Magazine's growing team of laser printer fanatics, reviews multiple-bin sheet feeders from BDT Products and Ziyad, designed to alleviate the work load of users of the original Laserjet, who are so busy running back and forth to the paper bin that they're keeping Reebok on top in the sport

shoc business. Wiswell went through several cartons of 20-pound bond to tell you how well they work (see "Laser Printer Technology: Sheet Feeders Multiply Your Printing Options").

A whole slew of vendors—both hardware and software purveyors—have seen an opportunity in the trials of Laserjet users. They've designed front generators, formatters, paper bins, boards, and the like to expand and upgrade the Laserjet's expabilties. PC Labs project leader Bill O'Brien selected a number of the best to tell you about, and more are arriving daily (see "Laser Printer Technology: Pluses for Your HP Laserjet").

PC Magazine's West Coast editor, Stewart Alsop, took PS Jet and PS Jet Plus, controller boards designed to give the HP Laserjet PostScript capabilities, for test drives. He found out that these beands are worth every dollar if you've already invested in an HP Laserjet sees sidebar. "PS Jet: Transforming Your HP with Post-

Script").
Winn L. Rosch—who has more patience with 25-pin D-shell connectors than most kindergarten teachers have with 5year-olds—focuses on printer-sharing hardware devices. He hooked up a whole

■ LASER PRINTERS UNDER \$3,000

raft of clewer printer-sharing devices and tells you here how they work (see "Laser' Printer Technology: Sharing Your Laser's Power"). If you have a LAN, you'll be retested in Frank J. Derfler, Ir.'s discussion of how to use it to share your laser printer (see the sidebar, "Sharing the Wealth: Using Your Network to Get the Most from Your Laser Printer!

THE ORIGINAL What made all these new printers and supporting products possible was the original desktop laser printer for the PC—the Fewlett Pakerdal Laserjet. When it burst on the scene almost 3 years ago, users spotted three things they liked very much: the Laserjet produced superblooking results; it was fast—at about 8 pages per minute (oppn) on straight text material; and it was quite—silent, in fact, except for the sounds of pager-hands of pager-hands of pager-hands.

At last, a no-compromises challenger faced down the daisy wheel printers that had dominated the office and serious-PC landscape since Diablo invented the breed. Thus, the first of the three advantages seemed almost a qualifier: if the printed results didn't at least equal the results from a Diablo, Oume, NEC, or other very good daisy wheel-in other words, passing the "good as Selectric output" test-the desktop laser wasn't going to make much headway. With an effective print-on-paper resolution of 300 by 300 dots per inch (dpi). first-generation desktop lasers could effectively simulate the look of typeset material, though only the Corona (now Cordata) and HP models offered familiar print-shop typefaces such as Times Roman and Helvetica.

The second advantage-8-ppm output-got more attention from those early tire-kickers than any other feature. Anyone who's waited for a multipage document to come grinding through the page-aminute-or-so speed of typical daisy wheel printers appreciates what 8 ppm can mean to efficiency. The new desktop lasers meant that you could print long contracts, manuscripts, reports, proposals, and other documents running more than a few pages on a demand basis, rather than queuing up for printing during lunch or overnight. In fact, first-generation lasers seemed so much faster than the daisy wheels they began to replace that, in many offices, printer

sharing finally began to make sense: two or three PC users shared one laser printer, through a manual or automatic switching arrangement.

What seemed the least important of the laser's three advantages at the beginning of the laser boom—silent operation—has finally gotten some respect. Anyone who's worked near daisy wheel or dot matrix printers and then listened to a laser printer in operation requires little persuasion that quiet counts. In fact, the smaller, lates!

■ The high-end daisy wheel, once the dominant printer for office PCs and word processing, is an anachronism

generation laser printers are being bought for executive offices and other applications where neither high print quality nor fast throughput is terribly important.

unoughput a sternby insportant, the first generation deskipt basers is now largely complete. Low-end lasers have devastated the high-end dalsy wheel market: the \$2,000 35: to 40-character per-second (cpp) daisy wheel (plus another \$500 to (cpp) daisy wheel (plus another \$500 to dominant printer for office PCS and word processing, is an anachronism. And midto high-end laser printers have largely resentation graphics" mean, as well as multiconfined what "little quality" and "presentation graphics" mean, as well as mulcolors.

SOFTWARE COMPATIBILITY As convenient and quiet as desktop lasers are, and as good as their printed results can be, many of them still present problems requiring more time, money, and patience than many PC users are prepared to invest in getting a new peripheral up and running. Compatibility with popular applications programs—as opposed to compatibility with the PC hardware itself—is the single biesees hurdle. Most lasers is us don't work

the same way as do other printers. Typically, they have their own quirky sets of escape-code sequences to begin and end character enhancements such as underlining and boldfacing, and they require special, nonstandard printer drivers in the applications programs with which they'll be

By now, most new releases of major applications include printer drivers for the market-leading HP Laserjet—and sometimes for the Laserjet Plus—in their setup routines. But few other desktop lasers have enough market standing to warrant such attention from software developers.

To get out of this jungle, printer manufacturers have either built enutlations of popular daisy wheels or dot matrix printers into laser printers or required users to purchase and use separate laser setup programs. The former sounds easy, but isn't necessarily a cinch, the latter shifts the burden onto the user, with unpredictable revults.

Adding emulation should work well, especially life being intered being emulated is already in wide use, so that all or nearly all PCs oftware packages support that perinter. It also appears easy enough, since each lase printer wends that puts its own label on a printer mechanism obtained from Canon, Ricoh, or another laser-engine manufacturer also produces his own printer-controller board, mounted inside the extensive controller board, mounted inside the sized emulation, circuitry onto the board cought to be routhed free. Unfortunately, experience has shown that there's emulation, and then there's emulation, and then there's emulation.

Emulating a popular and relatively primitive set of printer-control codes, of the sort used for alphanumerics only-such as the well-established and widely used Diablo 630 control sequence set-isn't so hard. The OMS Kiss and Big Kiss lasers, for example, built around the Canon laser engine, include circuitry that does a good job of emulating the Diablo standard. Because the Diablo 630 control codes set is so widely supported by applications software, it has been implemented on several desktop lasers, including many of the new, low-cost models, (PC Magazine thought the OMS Kiss laser printer was so good that we used it as the standard for the low-cost lasers reviewed here; our

THE RICOH ENGINE: PETITE AND POWERFUL

Besides being small and light, the Rivol 1060 Engine is also popular three of the five printers reviewed in this article use the 1060 Engine; the Okidata Laserline 6, the Epson GQ-3500, and the Rivol PC Laser 5000. The QMS Kiss printers are based on a Cannon engine, and the meW H2 Lasergl It is based on the newest engine in the Canon family, you'll get a good idea of what the new Canon engine can do in Bill Machrone's review of the Lasergle Series II.

A breakthrough in the design of the printer's photosensitive drum enabled Ricoth to make the engine so small. The drum is the component that gets charged by the laser's light and then picks up toner on the charged parts of its surface, which it deposits on the paper. Up until now, laser printers have required a drum or a belt whose circumference is at least so long as the page on which it prints.

Ricoh developed a system that works with a much smaller drum, using a patented "organic photoconductor," built with seamless construction so that the image is not marred by joints or seams in the middle of a printed page. This plays the major role in making the smaller engine possible.

As a result, one person can move a printer with a Ricoh 1060 engine fairly easily (two people are needed to carry a Canon-engine printer). A measure of a Ricoh-1060-based printer's portability is the fact that UPS will ship it, something it will not do with larger laser printers.

Ricoh provides separate toner, conductor, and cleaning magazine modules in the printer, making it possible to replace supplies as needed. The toner (\$29) should last about 1,500 pages. You need to change the cleaning magazine (which collects excess toner from the drum) every 10,000 pages (\$99). After every 20,000 pages, you should change both the photoconductor and the cleaning magazine, which come together in a kit (\$199). The engine notifies the operator when each type of change is required. In comparison with the Canon-based printers, in which you replace the drum every time you run out of toner, the Ricoh-1060-based machines should be more economical to run.

The only problem with this design is that you have to be extra careful when inserting some of the components. The photoconductor, for example, is unprotected, and although the manuals give produced to the property of the contraint of the contract of the contraction of the c

The engine has some design improvements in its favor, the best of which is the dual paper path. If you are using regularweight paper such as stationery or photocopier paper, you can turn a small dial

transport the unit.

that redirects the paper to a facedown his in the top of the printer for collated out-put. If you are feeding envelopes, acetate transparencies, sheets of labels, on heavy paper such as report coveres, you can restraight-through paper path that offers an almost perfect straight-line path through the printer. And life paper jams, it's not so bad; the unit is easy to open, and the unit is easy to open, and the unit of the paper jams, it's not so bad; the unit is easy to open, and they printer. And life paper jams, it's not so bad; the unit is easy to open, and they printer. And life paper jams, it's not so bad; the unit is easy to open, and they make the printer. And life paper jams, it's not so bad; the unit is easy to open, and they make the printer. And life paper jams, it's not so bad; the paper jams, it's not s

width paper input tray, plus a manualfeed guide. The engine also supports a bottom-feed paper tray, and while none of the manufacturers we contacted are shipping this option yet, all are developing designs for auxiliary trays that hold from 250 to 500 sheets.

All these features would count for litle if the engine's output were substandard, but the Ricoh 1060's print quality is outstanding. The engine prints large arass of black as well as or better than any other engine for a laser printer priced unfor \$10,000; its output easily surpasses that of the Canon engine in this respect, with the notable exception of the latest Canon engine, on which the new HP Laseriet Series I is based.

review of the QMS Kiss appeared in Volume 5 Number 19, page 268.) But moving into more-sophisticated

control sequences, as required by graphics, is a lot trickier. And laser printers that attempt full-blown emulation of, say, the

Hewlett-Packard Laserjet Plus code set stub their toes with regularity. Texas Instruments' new laser printers, for example, built around the first-generation Ricoh print engine, had problems with Laserjet Plus emulation. Even anoparently simple

graphics emulations, such as those for Epson MX/FX-80 graphics, turn out to be a lot tougher than some vendors expected.

lot tougher than some vendors expected.

If your software doesn't directly support the laser printer you want, and that printer either lacks emulation for a printer

■ LASER PRINTERS UNDER \$3,000

supported by your software or has a flawed emulation, laser setup software can spare you the agony of downloading tricky control character sequences.

Don't underestimate the complexity of these sequences. Here, for example, is what it takes to get an HP Laserjet to abandon its normal 10-character-per-inch Courier (internal) type that prints in "portrait" (vertical page) orientation and print in fairly common compressed (16-cp) type in "landscape" orientation—the long way across the page—from a font cartridge plugged into the front panel.

[ESC] (80[ESC]&110[ESC]9#8016.6658.5v8#-168T

I rest my case. You could automate the sending of that setup string with most keyboard macro programs, of course, and that's just what many early laser printer us-

ers did.

But before long a horde of specialized laser printer setup programs appeared. Because these programs "know" about the requirements of specific laser printers, they communicate with the PC user in relatively palain English and then compose and send the correct setup strings. Most can either ber una satadalones, before you load the application program to be used, or can oout within it for last-minute changes.

It's better by far to avoid setup programs altogether by choosing a printer with enough accurate emulations to work with your software.

PAPER, RAM, SPEED Beyond compatibility problems with existing applications software, lasers have other little quirks, like feebbe paper-handling capability. While it's nice that desktop lasers include built-in cut-sheer feeders without extra cost, most have only one feed tray. That's not very convenient for anyone who must print two-page letters—the first page on printed letterhead stationery, the second on matching unprinted paper store.

Only the HP Laserjet 500 Plus offers two paper-feed drawers that together accept a ream of paper at a time—a curious oversight on machines that are capable of emptying a 100-sheet feed drawer in less than 15 minutes. Moreover, all the desktop lasers built around the Canon engine eject their printed pages in backwards order, re-

quiring time-consuming and tedious handcollating to reverse the stack.

We look at some aftermarket answers to these paper-handling problems in this issue, but a fair question is, "Why should you have to turn to third-party vendors to get what should have been built in at the factory or offered by the printer maker as a tightly integrated, reasonably priced, userinstallable ontion?"

Similarly, you ought to be able to install at least a meagable and a half of memory as an inexpensive field luggrade of a half-brained laser printer without enough RAM on-board to produce full-page graphics at the printer's maximum resolution (invariably 300 by 300 dpi). Who wants to spend nearly \$3,000 to produce 75 by 75-dpi graphics output almost up to the standard of that old, uply, and obsolete BIM Graph-

ics Printer?

and with desktop publishing elbowing its way to the front of the PC industry, why don't we see reasonably priced, easy-to-install upgrades with page-description-language ROMs already in place? Hewlett-Packard has taken some steps in this direction to help Lassrejic owners who from the place in the place with they have been left out of the desktop publishing whit, and The Laser Connection also offers a replacement board for Laser-iest—PS it or 195 it Plus in the place of the place o

And what about all those Canon, QMS, and other laser printers? Are they destined to remain fast, quiet replacements for daisy wheels but cripples at printing high-resolution graphics?

Speed remains a problem, too, despite the allure of those 8-ppm specs. When you start reproducing graphic images on laser printers, speed falls way off, down to as slow as several minutes to print one page. The problem isn't the printer's so much as it is the system's: to reproduce a full-page 300- by 300-dpi image involves sending a lot of data to the printer to blink those 7,560,000 dots per page on or off. But using page description languages rather than the brute-force approach of raster (or dotby-dot) images can help, and Adobe Systems, developers of PostScript, and other PDL vendors have been working on faster. more elegant algorithms for packing data into less space.

Many of the new desktop lasers show intelligent planning and design to handle

the inevitable need for more memory and future releases of page description languages. The new Epson GQ-3500, for example, lets you add in memory up to 1.5 megabytes and add Diablo 630 and Laserjet Plus emulations to the built-in Epson LO-series emulation.

THE FUTURE. The next challenges for all parts of learn of low will be to live up to the possibility of a "form-free" office. Since, possibility of a "form-free" office. Since, possibility of a "form-free" office. Since, possibility of a "form-free" office. Since possibility of a "form-state of live and fill it in with indeed to a representation in one pass, we should be able to rid our offices of flowes closets, cablinets, rooms, and warehouses full of pads of forms that clutter our work lives. I help only a flow of the control of the contr

and a suck of pain paper.

Although some firms sell software and services to digitize, store, and recall teter-heads and even signatures on demand, in a first step towards that form-free office, few businesses do one-pass letterhead-plus-message printing on small lasers as yet. And although a few firms sell hardwarp-plus-software packages that make it possible to capture office forms layouts, store them in the printer, and recall them at print time, the process is expensive and, so far,

little used. Color printing is the second big challenge. Manufacturers are speculating that color lasers will appear on the market in late 1987 or 1988. The technology to produce color laser printing, especially under the \$5,000 barrier most market gurus posit as the threshold of pain for PC printer buyers, isn't quite ready yet. There's also a serious question about who needs color laser printing. And remember that shipping all that color information over to the printer will exacerbate the problem of printing speed. But within a few years, desktop color laser printers will probably be commonplace.

The real boost, though, to the establishment of desktop lasers as everyday PC tools will be the market success that the new, low-cost laser printers reviewed here are likely to experience this year.

-John Dickinson and Jim Seymour

John Dickinson and Jim Seymour are contributing editors of PC Magazine.

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Epson America Inc.

Epson GQ-3500

What would you expect from the biggest name in dot matrix printers for microcomputers? To live up to its forebears' reputation, an Epson America laser printer would have to be dependable, flexible, and compatible out of the box with almost anything. With that as an expectation, the Epson GO-3500 packs a few surprises.

A set of DIP switches on the printer interface board also gives you some control over printer features. The interface board is a small printed circuit board that slides into a small slot in the side of the printer. To change the settings, you simply turn two knurled screws and tug; no tools are required. The switch settings control the timing of the form-feed, the default page size and orientations, and the type of printer emulation.

You can select one of four emulations by using the DIP switches. The factory setting is what is called the page printer mode. Once are also choose line printer, letter-quality emulation, or the emulation provided in a separate card inserted in an option slot in the end of the printer. The area of emulation is where the printer's flaws are most apparent.

If you leave the printer in page printer mode, you have easy access to the full range of the printer's font controls. You can select different typefaces, different controls are select different typefaces, different forth, and proportional spacing, among others. Seven different forous are available: four portail-mode and three landscape mode fonts. The proportionally spaced font is the only one not available in the tandscape orientation. (The manual is undecided about how to distinguish between assembly uses the common "landscape"



book refers to "normal" and "rotated.")
One of the unusual commands in the page printer mode offers the ability to section the height and within of the character. It was to the character to be the control cash individually. You can have tall, skinny letters (triple-height, single, triple-width), or just plain giant ietters (triple-beight sold) both ways). These options are narred by both ways, these options are narred by the control cash individually. You can desire the control cash individually for the control cash of the cash of t

and "portrait" terms, but elsewhere the

The basic format control commands are similar to the traditional Epson command set, and the printer easily passed the performance tests for text-formatting compatibility with the Epson MX-80. The only flaw we found was that the boldface text was no darker hant the regular text. If you try to print Epson graphics, however, you'll be disappointed.

get novel effects with this command, but the quality is nothing to get excited about.

GRAPHICS PROBLEMS The Epson GQ-3500 does have sophisticated graphics capabilities in its page printer mode, but they are not compatible with the standard graphics commands. In addition to having the ability to create bit-mapped graphics, the printer also supports certain graphics primitives, which are commands that

make it easy to create and fill boxes and

circles. If you are writing your own pro-



The Epson GQ-3500's control panel buttons double up traditional functions such as form-feed with printer settings such as font selection. The status display is limited to cryptic two-digit prompts.

Does your laser printer have enough power to produce a stunning document?

Only SoftCraft offers you: 1. Font variety, 2. Formatting power, 3. The ability to create custom characters and symbols.

Armed with Fancy Word, Fancy Font or Laser Fonts your laser rinted becomes a high-quality alternative to expensive, time onsuming type-setting services. SoftCraft products maximize our laser printer's potential by easily turning your well-tern, recentation materials, documents and invitations into works of

In fact, this ad copy was printed using Laser Fonts on an HP

1. Font Variety

SoftCraft's complete library contains hundreds of fonts in various styles and sizes from 4 to 72 points. Each product comes with fonts in sizes from 8 to 24 points, including Roman, Sans Setti, Italic, Bold, Yoryk, Ølb English and more.

2. Formatting Power

In addition to all of the conventional formatting commands, Fancy Font includes commands that deal with variable-width (proportional) fonts and different height fonts. This is especially useful in setting tables, math formulas and perfectly justified text. Fancy Word and Lazer Fonts support all of Microsott Word's formatting features, no other codes or commands are required.

3. Create Custom Symbols and New Fonts
An included font editing program (optional with Fancy Word)
allows you to modify any character and create new characters and

logos, up to one inch by one inch. You can also create new fonts, scaled to size, from our database of character outlines.

Choose the Product That's Right For You

Fancy Font. A powerful text formatting and printing program that works with any word processor to provide a wide range of font styles and sizes. You embed simple commands in your document to control Fancy Font's extensive formatting capabilities.

Fancy Word: For Microsoft Word users. You use Microsoft Word like you always have, including the paragraph and character format commands, but you now print all the special characters, styles and sizes.

Laser Fonts: Downloads a large variety of fonts, up to 30 points in size, into laser printers at a significantly reduced price over HP. Laser Fonts automatically configures Microsoft Mord to fully take advantage of the downloaded fonts and can be used with any other word processor that can access soft fonts. Laser Fonts can also be used with Fancy Font or Fancy Word to dramatically speed printing on laser printers.

SoftCraft software runs on PCDOS and MSDOS computers with HP, Canon, NCR, Tall Tree and compatible laser printers (Laser Fonts requires a printer with download capability). Fancy Font and Fancy Word are also available for dot matrix printers.

Call TOLL FREE (800) 351-0500



■ LASER PRINTERS

grams, you can harness these powerful features.

If your program does not support the unique page printer mode commands, there is only one way to print graphics. You must set the printer for LQ emulation, and you can do that only by tuming off the printer and resetting the DIP switches. Once you do so, you lose access to many of the font control features. To make mat-

■ Poor graphics could be overlooked if good font support were provided, but the Epson missed the boat here, as well.

will be correct only under high-resolution (120 by 180 dots per inch) graphics mode. The biggest disappointment was that in spite of the Ricoh engine's ability to produce a stunning and solid black, the LQ emulation graphics were composed of visibly separate dots that ended up looking

slightly faded. Poor graphics could be overlooked if good font support were provided, but the Epson missed the boat here, as well. Of the seven fonts, only five are text. None support the higher-order characters, so they really have only half as many characters as most laser printer fonts. To provide compatibility with the IBM text graphics characters, Epson gives you a font called Extended Graphics. The major problem is that you must select either this font or a text font; you cannot use both at once. The graphics character font on its own is of little practical use: since it does not print a space character, all the line graphics get condensed into a meaningless jumble of characters. However, a separate command that is mentioned in the manual triggers the use of the higher-order characters with your current font.

Some of these problems will undoubtedly be addressed through the GQ-3500's ability to accept little integrated circuit

The PC Magazine Printer Guide



PC Magazine's Printer Guide provides data pertinent to your printer purchase decisions. Results come from PC Labs benchmark tests and hands-on evaluations.

PRINT QUALITY

To allow you to judge text and graphics print quality, text samples are shown both in their actual size and enlarged four times. The graphics sample—the PC Magazine logo—was created with a program customdesigned by Decision Resources of Westport, Connecticut.



SPEED

Rated speeds were obtained from the manufacturer. Default refers to tested speed in draft mode. Laser speeds are measured in pages per minute.

TYPE PITCHES

To give you a point of reference, 10 characters per inch is typical pica type, 12 cpi is typical elite, and 17 cpi is typical condensed mode.

FEATURES

Listings of each printer's printing and formatting features tell you how far beyond plain-vanilla printing it will go.

PRINTING FEATURES

- H Horizontal emphasis (bold)
 V Vertical emphasis (double strike)
- U Underline
- S Sub/superscript
 PC MAGAZINE APRIL 28, 1987

FORMATTING FEATURES

- P Proportional spacing
- P Proportional spac J Justified lines
- C Centered lines
- LH Variable line heights
- FL Variable form length
- HT Horizontal tabs

SOUND LEVEL

Sound level doubles for each 10-decibel increase under rat-life conditions. The average printer pounds away at 72 decibels. Although our equipment doesn't test accurately below 60 decibels, the manufactures raingia indicate that the laser printers are well below that level. Compare that with the 20 decibels of rustling leaves, the 50 decibels of the average office, or the 120 decibels of a rock connect. The blue bur shows the rated decibel level. The orage bar shows the measured decibel level. The



COMPATIBILITY

The Printer Guide reports on each printer's character compatibility with IBM's low (ASCII code 0-127) and high (ASCII code 128-255) order character set. Low-order characters represent the letters, numbers, and symbols found on the keyboard. The high-order IBM display characters include some line- and box-drawing characters that are useful for nongraphics drawing programs.



If your printer emulates (is compatible with) the text or graphics of a printer that your applications program supports, you'll have no trouble printing your output. We've tested for each printer's emulation of many of the more-common printers.

Laser Printers

(Products listed in ascending price order)

TYPE CARRIAGE WIDTH PRICE Laser

SPEED: Pages per

8 rated

TYPE

PITCHES:

Printing Char, per inc

FEATURES: SOUND LEVEL:

COMPATIBILITY: IBM cher. set

Okidata Laserline 6



Okidata Lase r Bold. Cour . Times Roman

wer On Defat asia r Bold. Cour \$1,995

18.0 5.8 default 18.8

PLHFL HT VT

52 < 60

OMS Kiss

QMS KISS Eps . Underline. ne. Power Or On Default.

t. Bold. Unc \$1,995

Laser

8 rated 7.0 7.4 defaul 10.0 12.0 18.7 HVUS

HT VT

PICIN

FL HT VT

55 64 PLHFL

Ω Epson FX, MX Epson FX,MX; Diablo 630; Qume Sprint 11 Plus

Ricoh PC Laser 6000



Ricoh PC 600 Bold and sha tury font. Pow and shadow. font, Power O \$2,395

8 rated 5.8 defau 10.0 12.0 15.0 18.7-point HYUS 52 < 60 Command Sel Diable 630

Epson GQ-3500

Epson GQ-35(urier. Do ackground.... Doubl cond. Power

8 default

10.0 HUS 12.0 13.0

52 < 60"

HP Laserjet Series II



HP LaserJet urier Bold. Courier Bolc 8510. . Courier Bo lt. Courier \$2,495

8 rated

10.0 7.5 defeult 15.8

all models **HP** Leserjet ali modela

OMS Big Kiss



QMS Blag KI ressed. Q-Roman ier 10cpi. Default. Epso -Roman ital 8.5 in.

8 rated 18.0 13.0 HYUS 7.5 default

12.8 18.7 P LH FL HT VT



■ LASER PRINTERS UNDER \$3,000

cards in two small slots in the machine. These can add more fonts or additional emulation options, but these cards were not provided with the machine we tested.

The GQ-3500 does print quickly and quietly at a good price. But compared with the existing competition, you can do much better.—Alfred Poor

Hewlett-Packard Co.

HP Laserjet Series II
Hewlett-Packard Co. created the desktop
laser printer market with a machine that
did little more than emulate a daisy wheel
printer. The market has changed dramatically since then, with the emergence of
high-quality graphics and desktop publishing. HP's Laserjet and Laserjet Plus were
beginning to look a little stodgy and expensive compared to the connection.

HP hasn't been resting on its laurels. The Laserjet II is a completely new printer. It's smaller and has more features than the old one but remains fully compatible and costs dramatically less. The Laserjet Series II is built on the new Canon engine and, at \$2,495, is priced aggressively.

The all-new design features in-order paper stacking, two font-cartridge sockets, an improved, 200-sheet paper tray, and a manual feed for undersized or heavy stock. Like the Laserjet Plus, the Laserjet II has both serial and parallel interfaces. It also has an I/O option expansion slot that ac-





The HP Laserjet Series II has dramatically improved on the Laserjet. It's smaller, fully compatible, and adds features like in-order paper stacking and a 200-sheet paper tray.

cepts either the forthcoming high-speed interface for the DDL page description language or a sharing device for up to three computers.

The Laserjet II has no configuration switches. You control everything from the front panel. A 16-character LCD gives you informative menus and access to everything, right down to fonts and symbol sets. The Print Fonts key on the front panel dumps all the fonts currently loaded in an attractive and useful format. It identifies them as internal, left cartridge, right cartridge, or memory resident. You can then use the font numbers and symbol set numbers to select the exact font and extended characters you want. The Laseriet II has more built-in fonts than its predecessor, with Courier, Courier Bold, and Line Printer in both portrait and landscape modes. Both modes also have a full IRM extended character set. Thus you can put the printer to useful work without buying

so much as a single font cartridge.

Speaking of which, the cartridges are coming down in price. Although they formerly cost in the range of \$200 to \$400.

they will soon be in the \$150-to-\$330 range.

Ha and several other companies offer a formidable range of downloadble soft fonts for the Lasejet (see "Laser Printer Technology. Pluses for Your HP Lasejet in this issue for more information). The Lasejet II is prepared to use more of them through its memory expansion capability. It comes with the same \$12X bytes as the Lasejet Plus, but you can get HP expansion bounds that take the total capacity to 1.5, 2.5, or 4.5 megabytes.

BLACK IS BLACK. Hewlett-Packard?competitors have taken some pleasure in pointing out that their offerings print is. They're going to have to find generalized feet occupiant about, because the Laserjett II has blacks that are simply stuming. The edge definition is better too, and some of the fonts have been reworked to improve definition even more.

Paper handling is likewise improved. At 200 sheets, the feed tray holds twice as much paper as the old Laseriet, and an ad-

WHAT HAVE THEY DONE WITH THE BERNOULLI BOX?



EVERYTHING THEY

Who are they? Over 100,000 computer users who have discovered a truly unique data storage solution-The Bernoulli Box™. Over 100,000 users who have learned firsthand why the Bernoulli Box has won the World Class

Award® as best product in its data storage category for the past two years. Over 100,000 users who have found hundreds of ways to improve their data management, growth, security and flexibility using the Bernoulli Box and its removable 10- or 20-megabyte disk cartridges. Over 100,000 users just like you.

ACCOUNTING:

A Big Eight accounting firm does extensive tax preparation and in-depth financial analysis, and maintains audit trails utilizing the Bernoulli Box. Its large 10- or 20-megabyte capacity provides adequate storage for such applications and security for each client. Instead of tying up the firm's mainframe system with heavy number crunching, accountants download client infor-

mation and data onto Bernoulli Cartridges and develop the client analysis at individual PC workstations.

> BANKING: A credit firm that supplies information to banks and other financial institutions employs Bernoulli Boxes to work with smaller banks and credit unions. Credit requests and information

are controlled on individual cartridges, making it easy to keep track of information and disperse it to the appropriate users. This unique approach to database management uses individual cartridges as electronic file cabinets, combining the best of physical and electronic data management. And instead of relying on electronic security measures, credit information can be kept private by removing cartridges and



safely storing them in a physically secure

DISTRIBUTION: A large lumber company in the

Northwest regularly sends its IIS offices Bernoulli Disk Cartridges containing

updates of rate schedules and lumber inventory. Instead of costly, time-consuming electronic transfer of data via modem, information is copied in just minutes onto cartridges which are mailed overnight to locations all over the country. This costeffective

transportation of is possible because

of the Bernoulli Box's rugged design and guarantee of interchangeability between systems.

MANUFACTURING:

An appliance manufacturer with massive inventory manages its large databases on Bernoulli Boxes. As parts lists and inventory lists are updated, the company's plant managers and distributors are kept current by sending them copies on cartridges. With large databases conveniently stored on individual cartridges, the manufacturer can more easily perform functions like process control, inventory control. equipment testing and data logging. Each function has a high data growth rate and requires large amounts of data, and managing both is an ideal anplication for the Bernoulli Box.

PUBLIC UTILITIES:

A utility company in one Western city uses CAD software and Bernoulli Boxes to keep track of a myriad of power and water lines. The company

has divided the city into quadrants storing the utility mapping for each quadrant on a single 20-megabyte cartridge. Copies can be quickly made to allow several people to work on different projects in the same quadrant at the same time. And cartridges can be easily archived for historical reference, just like electronic file drawers of information

PROGRAMMING:

One of the largest software developers in the U.S. uses Bernoulli Box Systems to manage enormous amounts of software source code. Because Bernoulli Disk



COULD THINK OF.

Cartridges come in 10- or 20-megabyte sizes, programmers are able to record their source code for an application on one cartridge, make backup cartridges for protection, and work directly from a "working" cartridge loaded in the Bernoulli Box. Programmers can change and modify code, or develop different revisions on multiple cartridges, without fear of damaging the original source code, which is safely stored on the "backup" cartridge.

An architect in Chicago uses over 40

Bernoulli Cartridges a year storing and

archiving lengthy architectural designs

GRAPHICS:





central database.

A medical insurance carrier with offices worldwide must keen track of an enormous number of records for millions of claimants. The company uses Bernoulli Boxes which allow easy access to information. infinite storage capacity and a simple system for database management of archival data, Individual offices use cartridges to update critical information on a timely basis and send updates to the company's

Boxes for data management, Large amounts of classified data can be stored on hand-carried Bernoulli Cartridges which are secured in vaults when not in use. In addition, specific pieces of data can be copied onto cartridges, rather than giving users access to an entire database of sensitive information.

THINK ABOUT IT.

But is a Bernoulli Box right for you? If you need to store a great deal of data, or you need to share that data with others, or you need to keep it completely secure or deal with multiple databases. it's time you

ONFIDENT

thought about the Bernoulli Box. If you turn the page, you'll find more food for thought. AND MORE.

GOVERNMENT CONTRACTORS:

An important defense contractor with need for total security on classified projects uses Bernoulli

A FEW OF OUR BEST CUSTOMERS. American Express Amoco Oil Arthur Anderson & Co. Bank of America Blue Cross/Blue Shield Campbell Soup Chase Manhattan Bank Citicom City of Dallas Coca-Cola Dean, Witter, Reynolds Florida Power & Light General Dynamics General Foods Harvard University IBM Intel

Lockheed Lotus Development McGraw-Hill Merrill Lynch Michelin Tire Corporation Mobil Oil Nabisco New York Life Insurance

Pacific Northwest Bell Parke Davis RCA Shell Oil Co.

Union Carbide United Technologies U.S. Army, Navy, Air Force Weyerhaeuser Co. Yellow Freight System





WHAT MAKES THE BERNOULLI BOX FLY?

in the truest sense, it is the remarkable Bernoulli Berholog¹ that makes the Bernoulli Box (hy That's because when a Bernoulli Box (hy That's because when a Bernoulli Box (hy That's because when a Bernoulli Box (hy House and hy House the House and hy House and he head in the deal simply cause the Bernoulli Box to temporarily fall safety way from the head. At the same time, the air flower could be the safety way from the head. At the same time to the time, the safety way from the head. At the same time to the time, the safety way from the time, the safety way from the could be the safety way from the could be the safety way from the safety way from the could be safety way from the safety way from safety way from safety safety



WHAT ABOUT VALUE? Of course, it takes more than break-

through technology to make a product worth buying. When you can buy a 10- or 20-megabyte hard disk for less than half the cost of a Bernoulli Box, why shouldn't you? Because the numbers tell a different story.

LOOK DOWN THE ROAD.

How much is expandability worth? While it may seem like you could never fill a 20-megabyte hard disk, you should look again. Twenty megabytes can go rather quickly. Then you have to buy another hard disk, or worse yet, store everything on floopoies.

When you buy a Bernoulli

Box, you buy unlimited data storage capability. When one 10- or 20-megabyte cartridge is full, you just put in a new one. For a fraction of the cost of a new hard disk. At that rate, it doesn't take long to bring the cost-permegabyte of your data storage down to a bargain level. Not to mention the efficiency gained in performance and

performance and managing data in large usable segments.

SHARE YOUR THOUGHTS.

How much does it cost to share data? You could buy a LAN to share large amounts of data with others. Or you could send it over modems. Either way, you pay a great deal for the Luxury of sharing data, and you tie up your network or your modem lines with the burdensome task of heavy data transfer.

When you buy a Bernoulli Box, sharing data is as easy as removing a cartridge and carrying it or mailing it where you want the data to go. The most you have to pay is a few dollars for postage or a few minutes' walk. And data stored on a Bernoulli Car-

20 + 20, 10 + 10, 10, 20.



tridge is much safer and more secure than data transferred electronically.

PROTECT YOUR INVESTMENT. How much is your

data worth? (Rules of thumb say \$1,000

per megabyte or your entire business.) You may use passwords for security, but how secure are passwords? The ultimate form of security is physical security. When you put your data on a Bernoulli Cartridge, you can remove it and store it safely, or even take it with you. That's secure.

For backup, floppies and lape are no match for Bernouli Cartridges, It takes just under two minutes to copy 10 mega-tytes on a Bernoulli Cartridge, It also takes scores of floppies to equal the storage of one Bernoulli Cartridge, and while you can work directly from a Bernoulli Cartridge, taped data must be transferred to a hard or floppy disk before it can be accept. Plus, with a dual drive Bernoulli Box, backup is built in, not extra.

A SEA OF ENTHUSIASTIC USERS. With over 100,000 Bernoulli Systems

and 1,500,000 Bernoulli Cartridges in use, the Bernoulli Box is more than a data storage option. It is a data storage standard. And Bernoulli Box users are our best references.

Give it some thought. Then put the Bernoulli Box to work, doing whatever you can think

of. For information, see your local Authorized Reseller, or call 1-801-778-3000.

FREE 1-YEAR
WARRANTY:
One-year invited warranty
on the Bernoulli Boat'.
Special second year
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■ LASER PRINTERS UNDER \$3,000

justable chure handles envelopes and oddsized pieces of paper. If you do much printing on special forms, you'll really a preciate being able to insert them from the front of the machine instead of from the front of the machine instead of from the back. Forms go into pifst, face up, which is much more convenient than the old way. A door at the back of the machine gives nonstandard forms a straight-through path, so they don't have to bend around to the receiver bin on top. At a tested 7.4 pages per intuitate, the new mealine printe search as minute, the new mealine printe search as to to worry about Laserjet computability; it is a Laseriet.

You'll appreciate two other improvements: The warm-up time is a mere 30 seconds, instead of the tedious 2 minutes of the old Laserjets. Also, the documentation is vastly better. You can actually find things, and the examples are easy to understand.

The Laserjet II is definitely smaller than the old Laserjet, but not as small as the Okidata and Ricoh machines reviewed here. On the other hand, it feels more solid than the smaller machines. Everything from inserting the paper tray to closing the toner drum cover proceeds with reassuring clicks, thunks, and feelings of solidity.

This printer is a winner. HP has obviously listened well to its customers and has built the Laserjet Series II to be competitive today and tomorrow.

-Bill Machrone

Okidata

Okidata Laserline 6

I was prejudiced about the Okidata Laserine 6, both favorably and unfavorably, before I plugged ii in. On the plus side, I have had an Oki 92 for years, and it has been a dependable workhorse. I have developed the impression that Okidata is the Avis of dot matrix printers; second behind the huge Epson, but trying harder to build more value into its machines. I expected Okidata's first laser printer to live up to that resultation.

On the other hand, I had already tested one of the other Ricoh-engine machines covered here and found it to be less than I had expected. I resigned myself to the apparent fact that the new low-end lasers



were short on features and would be a generally disappointing class of products.

wow, was I ever right and wrong! I should never have let my faith in Oki products waver, for the company has certainly packed plenty of value into this box. It is not competing with the other low-end lasers; it is hot on the trail of the big boys.

To start with, the Okidata Laserline 6 accepts different interfaces that are part of "personality" modules. To date, only one is available, but hat one emulates the HP Laserjet. Others are slated for release, including one that does HP Laserjet Plus emulation, plus a memory expansion capability that increases the page buffer from 128K to 512K bytes (which will allow up to half a page of 300-dot-per-inch graphics). Until then, you will have to settle for the HP Laserie remulation.

FONTS GALORE You might want the

HP Laserjet Plus feature so that you can use the downloaded font features. With the Laserline 6, you may find that you don't need that feature as much as you think. While the HP Laserjet comes with a grand total of two resident fonts, the Laserline 6 comes with 15 fonts, none of them dry or repetitious, either. You get Courier boldface and italic in portrait mode (in addition to the expected portrait and landscape Courier fonts), plus the 16.66-pitch Line Printer font that comes in portrait mode with the HP Laseriet Plus, except that on the Laserline 6 you get both portrait and landscape. You also get six 10-point and two 8-point Times Roman proportional fonts in portrait mode, including medium, holdface, italic, and compressed versions. You would have to spend hundreds of dol-



Okidata's Laserline 6 emulates the entire HP Laserjet command set. It printed the graphics test in low, medium, and very high resolution, and its Ricoh engine produced a strong black image.

■ LASER PRINTERS UNDER \$3,000

VDT-3	FORT	Epson 60-3500		Oktdata Laseriine 6	DMS Big Kiss	QMS Kiss	Ricoh Pi Laser 601
ABCDEFGHIJKLMNOPQRST	CENTURY PS Regular	0	0	0	0	0	•
abcdefghijklmnopqrstuvwxyz	COURIER 10-point	•	•	•	•	•	•
ABCDEFGHIJKLMNOPQRSTU	Courier Bold	0	•	•	0	0	0
abcdefghijklmnopqrstu	Courier Italic	0	0	•	0	0	0
ABCDEFGHIJKLMNOPQRSTUVWXYZ[EOP 7-point	•	0	0	0	0	0
abcdefghijklmnopqrstuvwxyz{	EPSON Pica	0	0	0	•	•	0
ABCDEFGH I JKLMNOPORSTU	Epson Pica Italic	0	0	0	0	•	0
abcdefgh i jk imnopqrstu	Epson Compressed	0	0	0	•	•	0
ABCDEFGHIJKLWNOPORSTUVWXYZ[\]^ '	Epson Compressed Italic	0	0	0	0	•	0
abcdefghljklmnopqrstuvwxyz{{}}"	Epson Elite	0	0	0	•	•	0
ABCDEFGH I JKLMNOPQRSTU	Epson Elite Italic	0	0	0	0	•	0
abcdefghljklmnopqrstu	HAMILTON Medium	0	0	0	•	0	0
ABCDEFGHIJKLMNO	Hamilton Medium Italic	0	0	0	•	0	0
abcdefghljklmnopqrstu	HELVETICA Bold	0	0	•	0	0	0
ABCDEFGHIJKLMNOPQRSTUVWXY abcdefghijklmnopqrstuvwxy	LETTER GOTHIC 12-point	0	0	0	•	0	0
	Letter Gothic 15-point	0	0	0	0	0	•
ABCDEFGHIJKLMNOPGRSTUVWXYZE\3^_'	LINE PRINTER Regular	0	0	•	0	0	0
abcdefghijklmnopqrstuvwxyz(}"#	Line Printer Compressed	0	•	0	0	0	0
ABCDEFGHIJKLMNOPQRSTU	MOOERN PROPORTIONAL 10-point	•	0	0	0	0	0
abcdefghijklmnopqrstuvw	PRESTIGE Elite 12-point	0	0	0	•	•	•
ABCDEFGHIJKLMNOPQRSTUVWXY	Prestige Elite IT12cpi	0	0	0	•	0	0
abcdefghijklmnopqrstuvwxy	Prestige Elite Italic	0	0	0	0	•	0
ABCDEFGH I JKLMNOPQRSTU	O-FORMAT 8-point	0	0	0	0		0
abcdefghijk Imnopqrstu	Q-Format 16-point	0	0	0	0	•	0
ABCDEFGH I JKLMNOPQR S TU	Q-ROMAN Medium	0	0	0	•	0	0
abcdefghijklmnopqrstu	Q-Roman Italic	0	0	0	•	0	0
ABCDEFGHIJKLMNOPQRST	TIMES ROMAN 8-point	0	0	•	0	0	0
abedefghijklmnopqrstuvwxyz	Times Roman 8-point Compressed	0	0	•	0	0	0
ABCDEFGHIJKLMNOPQRST abcdefghijklmnopqrstuvwxyz{	Times Roman 10-point	0	0	•	0	0	0
uncuej gnij kimnopqrstuvw 1921	Times Roman Bold	0	0	•	0	0	0
	Times Roman Compressed	0	0	•	0	0	0
●—Yes ○—No Whereas the original HP Laserjet came equipped	Times Roman Compressed Bold	0	0	•	0	0	_ 0
with only one internal font, machines we've re- viewed in the under-\$3,000 category can generate	Times Roman Compressed Italic	0	0	•	0	0	0
as many as 13.	Times Roman Italic	0	0	•	0	0	0

lars to get similar fonts in HP Laserjet car-

tridges, but here they come standard. Of course, emulation can be tricky to pull off correctly, and I am a little wary of anyone who claims compatibility. The Laserline 6 passed the printer performance tests for HP Laseriet compatibility for both texts and graphics, except that the cursor position reset to the home position before printing the graphics test. The printer was able to print the graphics test in low, medium, and very high resolution, and the Ricoh engine managed to produce a strong black image. For everyday word processing, I fired up XyWrite II Plus with the HP Laseriet driver, and the Laserline 6 handled boldface and underline without a hitch.

As far as I can determine, the Laserline 6 emulates the entire HP Laserjet command set. Many of the major software packages support these commands directly, which is just as well, because some HP escape commands can run 30 or more characters long.

If you have to set up the printer without assistance from your program, all is not lost. Okidata is currently bundling a printer utility caled LazerControl with the Laserline 6. Based on LaserControl 100 from Insight Development Corp., the program has been repackaged with a new manual and default settings designed specifically to take advantage of the Laserline 6's features.

Laser-Control is one of the best HP Laserds setup programs; you can use if as a program called from DGS or load it as a program called from DGS or load it as a pro-pre-sident untillty. Not only can you set various printer settings and select fons but you can also choose from Diablo, NEC, Qume, Epson, and IBM Graphication with the graphics test, and the printer praced with flying colors. Trace cmulabent programs with the properties of the propagarant that may not support the HP Laserte commands directly.

So the Laserline 6 gives you more standard fonts than on an HP Laserjet Plus, total Laserjet command compatibility, more printer emulation options than the QMS Big Kiss, and one of the lowest prices going. The Okidata Laserline 6 packs enough value to make it worth quite a bit more, but at this price it is a flat-out bargain. This printer should not only give the daisy wheel manufacturers fits, but it may shake up the upper levels of the laser market as well.—Alfred Poor

OMS Inc.

OMS Big Kiss

QMS shook the micro printer market last year when it broke the \$2,000 barrier for laser printers with the QMS Kiss. Based on the Canon engine, this no-firll printer offered emulation of a few popular daisy wheel and dot martix printers and nine utilitarian monospaced fonts (seven portrail and two landscape). (See review in "The Third Annual Survey; Printers," PC Magazine, Volume 5 Number 19).

For some users, the QMS Kiss, true to its name, "Kept it Simple, Sweetheart," but too simple. They wanted more from their laser, and QMS responded with the Big Kiss. This newer model starts with the same 8-page-per-minute Canon engine and all the features of the lesser Kiss and builds on them.

ouilds on them.

The most immediately apparent im-



QMS Big Kiss QMS Inc. One Magnum Pass Mobile, AL 36618

(205) 633-4300 List Price: 52,995, with 640K RAM, 17 resident fonts, toner cartridge. Starter kit, in-

larger and not necessarily better.

868 NEADER SERVICE CARE

chading toner cartridge, ream of paper, tunoral, and utility software, \$18.5. Dimensions (HWD): 11.5×18.7×16.3 in. Weight: 65 lbs. In Short: The big brother of the QMS Kiss, this laser printer is faster than the other lowcost lasers and offers Qurne, Epsen, and Diable ormulation and up to 64 forms, but it's also

provement is that the Big Kiss has more fonts. It lacks the large sams serif font of the Kiss, but it adds a medium and an italic font similar to a Times Roman, two sams serif proportional uprights and an italic, and a 13-pitch landscape font. In all, the 14 fonts give you enough to choose from for



The QMS Big Kiss offers resident emulation of the Diablo 630, Epson FX-80, and the Qume Sprint. Through these emulations, you should be able to easily run and load most major software.

More than the Iling PC software The Standard independent software developers Lotus HAL, Freelance Plus, etc.

1-2-3° is more than just the best selling PC software package in the world. It's a system. A system that includes a wide range of Lotus" products that work with 1-2-3. Including Lotus HAL for easier and faster use of 1-2-3. 1-2-3 Report Writer for reports, forms and mailing labels. And Freelance Plus-for business graphics.

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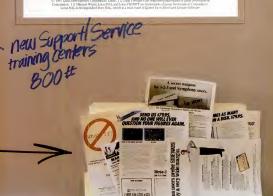
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Lotus 1-2-3

Business software integrating spreadsheet, graphics and database.

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LASER PRINTERS UNDER \$3,000

If you need other fonts, you have other options available. The printer accepts optional font cartridges that insert into a slot on the front of the printer, much like the HP Laserjet printers. (Since the test unit supplied no cartridge, we did not test this feature.)

■ One of the most striking features of the Ricoh PC Laser 6000 is the amount of memory available: 1.024K bytes!

Also, two commands permit you to copy from into the printer's memory, to can use either the special QMS command language or if you are using the language or if you are using the language or member to mand. If you are using a utility program that offers Epson fonts, remember that the characters will be defined only to the 8- by 9-dot matrix supported by Epson FX series printers, so your lenters will not have as fine a resolution as that of the resident or cartridge fonts.

MEMORY OF A KISS One nice feature about the download capabilities is that you can copy cartridge fonts into memory. You can then remove the cartridge from the slot and insert another one. In this way, up to 64 fonts can be available at one time, provided that you have sufficient memory in your printer.

As with the Kiss, one of the printer's strongest features is that it offers resident emulation of three popular printers: the Diable 630, the Epson FX-80, and the Qume Sprint. Through these emulations, you should be able to load and run almost any ampior software without too much hassle. The printer passed the printer performance tests for text command compatibility with all three printers (although the boldface did not work well).

One problem with the two daisy wheel emulations is that they do not support the use of the proportional fonts. This seems

PCL

Laser Printers: Manufacturers' Specifications Table

Product Manufacturer	Okidata Laserilae 6 Okidals	QMS Kiss OMS Inc.	Ricoh PC Leser ecoo Ricoh Corp.	Epson GQ-3588 Epson Americs Inc.	HP Leserjei Series II Hewlett- Packard Co.	QMS Big Kiss QMS Inc.
List price	\$1,995	\$1,995	\$2,395	\$2,495	\$2,495	\$2,995
RAM	272K	384K	1 Mbyte	640K	512K	640K
Parallel port	0	•	•	•	•	•
Serial port	0	0	•	0	•	0
Toner cartridge (including developer)	•	0	•	•	•	•
Print/image drum or organic photoconductor cartridge	•	0	•	•	•	Included in toner cartrid
Engine	Ricch 4600	Canen CX	Rapph 1060	Record [†]	Canon SX	Canon CX
FONTS						
No. of built-in fonts	15	12	8	7	6	17
No. of font cartridge slots	1	0	1	2	2	1
PERSONALITY MODULES						
Built-in modules	0	•	0	•	0	•
Slide-in modules	0	0	•	0	0	0
Epson FX-80	0	•	0	•	0	•
Epson MX-80	0	0	0	•	0	0
1BM Graphics Printer	0	0	0	0	0	0
1BM Proprinter	0	0	0	0	0	0
Diablo 630	0	•	•	0	0	•
HP Laserjet	0	0	0	0	0	0
HP Laserjet Plus	0	0	0	0	0	0
Other	0	Quine Sprint	0	0	0	Quine Sprint Ansi X3 64
PERFORMANCE						
Pages per minute, claimed	6	6	6	6	8	8
Pages per minute, tested	6	6	6	6	7.5	7.5
Rated machine life before major overhaul (pages)	180,000	100,000	180,000	180,000	info not available	100.000
Railed duty cycle per month (pages)	3,000-5,00	0 3,000-5,00	3,000	3,000	5.000	3,000-5,000
PAPER HANDLING						
Output delivered in correct order	•	0	•	•	0	0
No. of paper trays	1	1	1	1	1	1
No. of manual paper feed slots	1	1	1	1	1	1
Sheet capacity of paper tray	150	100	150	150	200	100

OPTIONS					PC	
Product Manulacturer	Okidata Laserline 6 Okidata	QMS Kiss QMS Inc.	Ricoh PC Laser 5000 Ricoh Corp.	Epsoe 60-3500 Epson America Inc.	HP Laserjer Series II Hewlett- Packard Co.	QMS Big Kiss QMS Inc.
Memory	656K	None	512K	1.5 Mbytes	1 Mbyte; 2 Mbytes; 4 bytes	None
List price	\$399	N/A	\$249	Info not exadable	\$495, \$4,995 \$1,95	N/A
Serial or parallel interface	(\$800)	0	0	0	0	0
TONER CARTRIDGES (in	cluding devel	oper)				
Sealed units	•	•	•	•	•.	•
List price	\$29	\$99	\$29	\$29	\$119*	\$99
Life (pages)	1,500	3,000-5,000	1,500	1,500	4,000	3,000-5,000
PRINT/IMAGE DRUM OR		PHOTOCO	NDUCTOR	CARTRIE	QE	
List price	Kit 1, \$199 Kit 2, \$89	facluded in toner cartridge	\$1991	\$1995	\$119*	Included in toner cartridg
Life (pages)	10,000 each kit	Included in toner cartridge	20,000	20,000	4,000	Included in toner cartridg
FONT CARTRIDGES						
No. available	4	0	11	10	23	17
List price	\$149 each	N/A	\$200-\$300	\$149- \$199 95	\$150-\$330	\$249-\$299
Multiple PC option	•	0	0	0	0	0
List price	\$600	N/A	N/A	N/A	N/A	N/A
PERSONALITY MODULI	ES .					
Diablo 630	0	0	0	● (\$169.95)	0	0
Epson FX-80	0	0	● (\$199)	0	0	0
HP Laserjet	0	0	0	(price unavariable)	0	0
HP Laserjet Basic	● (\$200)	0	0	0	0	0
HP Laserjet Plus	0	0	● (\$199)	0	0	0
HP Laserjet Plus Advanced	(\$400)	0	0	0	0	0
HP Laseriet Plus Multi-User Advanced	● (\$600)	0	0	0	0	0
IBM Proprinter	0	0	● (\$199)	0	0	0

unfortunate, since one of the main differences between the Big Kiss and its less capable sibling is the use of proportional fonts. While you can use the commands to tum proportional spacing on and off, you are advised to use only the 10-pitch fonts because the others cause the margins to change.

The Epson emulation also did a fine job with graphics. The printer managed both regular- and high-resolution FX-80 graphs coupur without a hirch, although the Canon engine does not print as solid or black image as the Ricohengines does not print as solid or black image as the Ricohengines does not print as solid or black image as the Ricohengines does not graphic can print 300 does per inch. Job of the Epson high-resolution mode can produce only 120 by 14 does per inch. As a result of this combination, you get a very sharp image of a come graphic.

The Big Kiss measurably increases your control over graphics and other features through another "emulation," called Features through another "emulation," called KNIS 13.64, which is based on the American National Standards Institute specifications for the transfer of data between terminals. In addition to giving you bit-mapping and cursor control, the commands also let you specify forus, and draw graphics primitives such as lines and boxes. Unfortunately, this can be considered to the proposed and therefore or only limited upoptions and therefore or only limited upoptions and therefore or only limited upon the present unless you are developing your won programs or drivers.

Like the regular Kiss, this printer has a control panel that you can use to change the various printer settings without the use of complex escape command sequences. You can select fonts, change margins, select the emulation mode, and more. A twodigit readout shows the prompts, and as a result they are a bit cryptic. You can toggle some options off and on and set others by using the appropriate digit. The accompanying manual does a fairly good job of explaining the use of these front-panel settings, but getting the hang of it still takes some amount of practice. Fortunately, the printer worked flawlessly straight out of the box without any need to change the factory default settings.

At 7½ ppm, the QMS Big Kiss is faster than the other low-cost lasers reviewed here, but speed is one of its few outstanding virtues. It is also about a third larger,

-Indicates Editor's Choice

●—Yes

O-No

N/A—Not applicable

*HP Laserjet Series II includes an EP cartridge that contains toner, developer, and a print drum.

* Ricoh will not release the engine model type.

priced at \$99.

1 Collector has a 10,000-page life and is priced at

■ LASER PRINTERS UNDER \$3,000

costs \$500 more, and is nearly twice as heavy as the other primers covered here. The printer has plenty of fonts, which are nice to have, but personally! Ifind some of them less attractive than the fonts of other laser printers. Overall, its added features do not warrant mowing up from the original Kiss. Perhaps the simple solution was a better idea.—Affred Poor

Ricoh Corp.

Ricoh PC Laser 6000

Ricoh has long been involved in the electronics industry, but its name is not well known since it primarily supplied components and products to other manufacturers. It has recently started marketing products under its own name, first with the larger LP4080R and now the Ricoh PC Laser 6000.

The PC Laser 6000 uses the same print engine as the Okidata and Epson printers reviewed here, but it has its own personality traits.

When you run the printer self-test, you get a printed summary sheet showing the different printer settings and features. One of the most striking features listed on the sheet is the amount of memory available: 1,024K bytes! Yes, you get a full megabye of memory in the standard machine. You can expand the memory to 2 megabyes by using half-megabye modules (at \$249 each). As a result, you start with more memory than an HP Lasejet Plus,



In Short: This low-cost laser printer gives

you a full megabyte of memory and some

very promising graphics capabilities



The Ricoh PC Laser 6000 controller can print fonts in portrait or landscape mode. Its compressed font mode squeezes extra white space from letters in the smallest font to produce a 16.6 pitch font.

and you can expand to enough for full legal-size page graphics in 300-dot-per-inch resolution and still have room for dozens of downloadable from

On the other hand, the summary sheet shows that only four fonts are available: 10-pitch Courier, 12-pitch Prestige Elite, 15 pitch Letter Gothic, and proportionally spaced Century. This would appear to be a striking limitation, but as it turns out, you effectively get ten different fonts. The PC Laser 6000 controller is unique among low-end laser printers in that it can print any available font in either portrait or landscape mode; other printers require two separate fonts to achieve this. The printer also has a "compressed font" mode, in which it squeezes extra white space from the letters in the smallest available font to produce a 16.6-pitch font. This operation, which is done on the fly, does not require a separate resident font.

The PC Laser 6000 has its own set of commands, and it also emulates the Diablo 630 to enable you to take advantage of many of the Diablo's features for text printing. Unfortunately, the native graphics commands are not as widely supported

(although a company spokesman reported that 1-2-3 and PC Paintbrush are two examples of major programs that now offer drivers for the Ricol graphics commands). For extensive use of the printer's graphics capabilities, you may need to purchase one of the emulation modules.

MODULES COMING SOON Currenlation cartridge (at 5199), but it was unlation cartridge (at 5199), but it was unvaliable for testing for this review. IBM Proprinter and Epson FX-80 emulation for the properties of the state of the state (state of the state of the state of the state (state of the state of the state of almost any major software program. Since we were not state of the state of

The PC Laser 6000 is easy to set up, as it comes with both parallel and serial connectors. I was able to plug it in and produce a screen-dump page in just a matter of minutes. The character set does not support the higher-order IBM line graphics characters, but they are available in the add-on four



• HP Laseriet Series II

Hewlest-Packard's Laxerjet Series I has it all: snaller size, more features, lower price, the same old speed, and better quality. The new Ricch-engine machines are interesting, but the HP Laxerjet II's nadae difference. The Laxerjet II's massion, memory capability, IIO expansion, and dual cartridge slots say that this machine means business.

cartridges. Eleven different cartridges are now available—the same ones designed to work with the other Ricoh laser printer. (The font cartridges list for \$200 to \$300 apiece.)

The printer has a powerful control panel on its side that gives you access to almost all the settings and features without having to send escape commands. Two separate single-digit readouts display the prompts; you press combinations of buttons to change the settings. The same buttons also handle font selection, page orientation, form-feed, and self-test, so it can be a bit confusing to figure out how to get the effect you want. The manual tries to explain the procedure, but it is somewhat confusing in its example. According to a company representative. Ricch is developing a cue card about the use of the front-panel controls, with examples of how to achieve certain effects with various popular programs

While its enulation features are still untested, the PC Lawer 6000 shows a for for prunise. It provides more memory for the dollar than any of its competitions, and it has the potential of being the best of the bunch at producing graphics. As the designer of the print engine itself, Ricoth has done a good job of making the most of its capabilities with the PC Laser 6000.

Alfred Poor is a frequent contributor to PC Magazinc. Bill Machrone is the editor of PC Magazine. "I need a LAN that installs easily and quickly."



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timesharing by sharing a central PC's peripherals, files, and processor time among nine users. Up to eight in-expensive terminals can be connected to a single nondedicated IBM PC, XT, AT or 100% compatible using standard RS-232 ports. Each terminal effectively emu-

lates a PC having up to 512K RAM. PC-Shadow Workstations, shown below, even have an AT look-alike, as well as work-alike, keyboard, display, and serial port. In addition, password-protected remote access via modern can be made with either dumb terminals or PCs running our terminal emulation software. avancink reans PC-DOS Compatibility with a Software Driven System. Lotus 1-2-3, Symphony, WordStar, dBASE III. & Multimate are just a sampling of the wide variety of PC-DOS software that's fully compatible. MultiLink® Means PC-DOS Compatibility with a

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TECHNOLOGY

Sheet Feeders Multiply Your Printing **Options**

Marrying a multiplebin sheet feeder to a laser printer gives you longer print runs, less drudgery. ser printer alone? You can also print envelopes in the

same iob.

category of multiple-bin sheet feeders for laser printers is something most people don't think about. When they do think about it, they cannot imagine its usefulness. After all, laser printers use cut sheets already, and even though some can't fit envelopes, their manual paper-feed chutes can accept any standard-size form. In fact, laser printers generally have built-in sheet feeders, and many even do reverse-order stacking. What could you do with a multiple-bin sheet feeder that you couldn't do with a la-

Well, for one thing, you can print letters and their envelopes as one print job. saving a lot of time and effort-particularly for large mailings. So one of the most important considerations in shopping for a sheet feeder is its ability to handle envelopes of various sizes. (All the separate sheet feeders that we looked at here do include hins for envelopes)

For another thing, you can print from your choice of standard- and legal-size forms without changing the paper tray. The ability to print a spreadsheet horizontally and vertically using different lengths of paper and even combining lengths and orientations is fantastic. So bin size is also important-not just for the number of sheets each bin can hold, but for length of the paper, too.

Of course, another benefit is that stacking all the bins full of the same paper or form requires far fewer trips to the printer. One of the feeders we reviewed here-the six-bin BDT MF 830-has a total capacity of 1,200 sheets. You could have a 21/2hour lunch while a laser printer churned out that much work.

But as good as sheet feeders might sound, think before you buy. All the sheet feeders we looked at are expensive, considering the yield (around \$1,500 for three extra bins, up to about \$4,500 for six extra bins). Be sure you have a well-defined need for one of these feeders before you let a salesman talk you into trucking one into the office. If you do have an application that could benefit from adding a sheet feeder to your last prince review in fail feeders to you for the prince prince to the too him the Sto Laser Feeder from BDT Products, and the Paper1et 400 from the two-bin HP Sao Laser Feeder from BDT Products, and the Paper1et 400 from the two-bin HP Laser feeders and the two-bin HP Laser feeders graphitics we also reviewed.

BDT Products Inc.

MF 850 Laser Feeder

The combination of a laser printer and the vorbin MF 850 Laser Feeder, from BDT Products, yields a generous total of four separate bins: the printer's originaper tray, plus the MF 850's two bins for paper tray, plus the MF 850's two bins for paper and one for envelopes. Thus the MF 850's two bins for paper and one for envelopes. Thus the Mred printing documents on your choice for printing documents on your choice for printing documents on your choice for the different forms stored in the three bins, or of printing a three-page letter, including envelope, using different stationery for each page.

You can select the bin in two ways: from the feeder's control panel by using the push buttons, in which case all pages must be printed from the same bin: or from



MF 850 Laser Feeder BDT Products Inc. 17152 Armstrong Ave. Irvine. CA 92714 (800) FIND-BDT (714) 660-1386

List Price: \$1.695, including Flapper output collator. Requires: HP Laserjet, Canon LBP-8 (A1 and A2), QMS Kivs, QMS Big Kiss, QMS SmartWriter, GTC Blacer, BDS 630/8, CPT LP-6, Data General 4557, Duta General 4558, NCR 6416, Talaris 7810, or Talaris

In Short: A sturdy three-bin sheet feeder (two bins for 200 sheets of paper each; one for envelopes) for laser printers, CIRCLE 800 ON READER SERVICE CLARS



With BDT Products' MF 850 Laser Feeder, you can print documents on three different forms stored in the three bins, or a three-page letter using different stationery for each page.

the text file by inserting printer escape codes, in which case you may print any page from any bin.

The MF 850 has the look and feel of a well-made machine. The manual clearly explains how to assemble its nearly two dozen parts and how to connect the feeder to the laser printer; so if you'r familiar with your printer; you should be able to install the MF 850. You won't need a special technical knowledge or any tooks, and all parts snap or side together easily. But you should plan on the process taking at least an hour.

The MF 850's case, made of the same color and material as an HP Laserjet, slides up against the cear of the printer and aligns the paper path on the feeder with the printer of's manual paper-feed chute. The rear "feet" on the printer and the front "feet" on the feeder fit into slots on a flat template, so you can disconnect and reconnect the two units easily and quickly.

The MF 850 adds no width to the printer, but it nearly doubles its depth, so table space is definitely a concern. The two paper bins and the envelope bin stick up above the height of the printer so that you can easily view, rearrange, and refill them if necessary. Incidentally, you can open the laser printer cover and hinge it back with the feeder installed.

The small control panel for the feeder thus ends up at the right rear of the combined units—a long way from the control panel for the printer. Still, you won't find much reason to use the control panel on the feeder, except to test each bin's operation.

Tecoder, except to test each bin's operation.

A built-in test allows you to feed and print from the three bins. If something is not lined up correctly or if paper is inserted upside down, you will discover the error by trying this simple test procedure after installation or whenever new stacks of forms are added to the bins.

Otherwise, the control panel lets you take the feeder on off line, dump lis buffer memory, and form-feed from the currently selected bin. It also delivers numerical codes on its LED display in the event of errors and these are helpful in determining the problem. Error codes are listed in the documentation. Three LED lamps deliver the status of power, ontoff line, and printer ready. All three must be lit before you can print using the Feeder.

The MF 850 is connected between the printer and your computer so that it receives and reads all data being transmitted before the printer does. Thus, operation of the laser printer does not change, except when you want to feed from one of the alternative bins via escape codes. The feeder interprets these codes before the data reaches the printer, selecting and feeding the proper form or envelope to the printer. If your document contains no codes, the printer prints it on the paper in bin 1 on the feeder by default.

Don't be worried about these feeder codes, however, because there are only nine of them: ESC EM 0 through ESC EM 8. The codes perform the following functions: feed from manual chute, feed from bin 1, feed from bin 2, feed from envelope bin with landscape orientation, feed from internal paper tray, feed from envelope bin with portrait orientation, feed alternately from bin 1, bin 2, and the internal tray, feed alternately between bins 1 and 2, and return to the default bin 1. You must insert the codes in the document, with each appearing as the first printable characters of a page. Thus if you can create a hard page break with your word processor or editor and insert the codes immediately after these breaks, you may change bins to your heart's delight throughout a document.

If you need versatility in your feeder, you should investigate the MF 850. It handles envelopes of varying size well, plus it has the capacity to handle different forms in the three bins. (If you're in the market for a sheet feeder like this one, you'll want to compare this unit to the Paperlet 400 for your laser, reviewed here, which also has two paper bins and one envelope bin.)

BDT Products Inc.

MF 830 Laser Feeder

The MF 850's big brother is the six-bin MF 830 Laser Feeder (priced at \$4,495), also from BDT Products. When the staff in PC Labs showed me this unit, still in its box, I stood beside it in awe for several minutes, debating whether to uncrate the feeder or head for the door. You could bury two of me in smaller boxes than the one that protects the MF 830 during shipping. I figured anything this large can't be simple to install or operate, but oddly, this six-bin feeder required less time and patience to install than its little brother. The biggest problem I had with this unit was moving it from the box to the testing bench.



Requires: HP Lascriet, HP Lascriet Plus, or

feeder that can accommodate up to 200 sheets

In Short: A six-bin powerhouse of a sheet

LE MAN ON READER SERVICE CARD

Canon LBP-CX (A1 and A2).

per bin

The MF 830's feeder unit comes mounted on one-half of a rectangular board that measures about 2 feet by 5 feet. You position the two rear "feet" of your laser printer in slots on the other half of the board, then slide the units together until the forms slot on the feeder is lined up with the manual paper-feed slot on the rear of the printer. You then fill the six paper trays with paper and insert them into their slots, where they automatically lock in place. Finally, you attach the serial cable from the computer to the feeder, and then connect another cable from the feeder to the printer. In this way, the feeder is positioned to intercept feeder codes, execute paper trav selection, and remove the feeder codes from a document before data reaches the printer.

You can install the envelope tray in slots 2 through 6; but not in the first slot, which is reserved as the default paper tray. If the feeder finds no feeder codes in a document, it prints from the tray in slot 1.

ument, it prints from the ray in six of 1.

The MF 830 can read 13 different feeder codes embedded in a document. Eight of them allow you to select forms from the six feeder tray, or the printer's internal paper red, and the other five let you designate an envelope feed from bins 2 through 6. Unfortunately, unlike the MF 850, the device has no feeder commands to alternate bins in a pattern.

The operator control panel of the MF S0 includes three LED status lamps to indicate power, on/off line, and printer ready. It also has a two-character digital LED display that identifies errors as ramerical codes, plus six push buttors. These buttons allow you to reset the unit. These buttons allow you to reset the unit. The printer of the code of the printer of the code of torn, manually select as lin, interrupt the feeder, restart the feeder, and return the bin selection to its default status of the code of the code of the code of the code of the self-test of the unit from this control panel is simple.

However, while the documentation for the three-bin MF 850 is nicely typeset and has clear diagrams, the documentation for the MF 830 comes as two packets of poor-



BDT Products' MF 830 Laser Feeder is a behemoth. Mounted on one-half of a 2- by 5-foot board, it has six paper bins. (The phone is included to indicate the machine's true size.)

■ SHEET FEEDERS

ly photocopied pages whose diagrams are thus somewhat obscured, along with four or five loose sheets of addendum material. It is poorly written and organized, offering less information on how to insert codes into a document than on how to fan a stack of paper so that it won't stick in the feeder. Despite this lack of help, however, I encountered no problems assembling or running the unit

he MF 830 is a powerhouse for printing multiple forms. The total of seven paper bins (one in the printer itself) should alleviate most of the problems associated with printing from a variety of forms or handling mass mailings with envelope addressing on a laser printer.

Hewlett-Packard Co.

HP Laseriet 500 Plus

The Hewlett-Packard Laserjet 500 Plus is not a sheet feeder. It is a complete Laserjet printer that costs \$4,495 and has two internal paper travs, allowing you to select two different types or sizes of paper through sheet feeder codes embedded in your documents. The printer does not have a separate envelope bin, however, so to print envelopes-as with all other Laserjet printers-you must feed them manually through the chute in the rear.

Obviously, the Laseriet 500 Plus does not provide the flexible capabilities of the three sheet feeders reviewed here, but it does have some graceful and useful features. In the first place, the 500 Plus gives



HP Laserjet 500 Plus Hewlett-Packard Co. t131t Chinden Blvd. Boise ID 83714 (800) 367-4772 List Price: \$4,995, including 512K RAM, seven fonts, and toner cartridge. In Short: A laser printer with two per bins that each hold 200 sheets, but lack-

ing an envelope bin. Based on Hewlett-Packard's original Canon engine, not the new Lat Series II engine



One nice feature of the HP Laseriet 500 Plus is job offset control, which mokes it possible to alternately stack sequential print jobs vertically and horizontally for easy separation.

you not only your choice of reverse- or correct-order stacking, but also provides job offset control. Job offset control means that sequential print jobs alternately stack up horizontally and vertically for easy separation.

Embedded escape codes let vou select each of the printer's two bins for use during a print job; otherwise a nifty Auto Select mode will print from one bin until it's empty, then switch automatically to the other bin. This extremely handy feature gives you a capacity of 500 sheets of the same form, 250 sheets per bin. The bins are stacked one above another. Except for the printer's increased height, it looks pret-

ty much like the rest of the Laserjet family. Except for filling the second paper tray. you don't need to use any extra setup procedure or installation for the two bins on the Laserjet 500 Plus. The Laserjet 500 Plus will interest users who need to print business letters using letterhead for the first page and plain sheets for subsequent pages, and users who print frequently on either 11- or 14-inch-long paper, which they keep loaded in the bins at all times. It's an excellent choice because it requires no additional assembly (there's nothing to

The 500 Plus lets you choose reverse- or correct-order stacking.

widget together), and costs less than a Laserjet from Hewlett-Packard with a sheet feeder from another company.

The lack of an envelope bin on the Laseriet 500 Plus is regrettable, since a bin for envelopes would almost double the effectiveness of the Laserjet 500 Plus as an alternative to adding a sheet feeder to an existing laser printer.

One minor drawback to the Laserjet 500 Plus is age. It's based on the same venerable Canon LPB8X technology of the Laserjet and Laserjet Plus but HP has superseded these with the Laserjet Series II, which has a new Canon print engine, and the output is noticeably blacker and crisper. For a review, see "Laser Printer Technology: Great Performance for Under \$3,000" in this issue.

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SUPER LITTLE ONE-BIN FEEDER: JETFEED I FROM GENESIS TECHNOLOGY

Just as I was wrapping up the reviews of multiple-bin sheet feeders, the brand new JetFeed I single-bin sheet feeder for laser printers arrived in PC Labs from Genesis Technology. Although PC Magazine does not review preproduction models and this unfinished model was missing some of its firmware, we were curious about the new feeder from Genesis and agreed to take an early look. Here's what we saw.

Unlike the other, multiple-bin sheet feeders I looked at, the JetFeed I gives you only one additional bin. Designed for the user who wants to do large print jobs unattended, this single bin holds up to 500 sheets.

The single-bin JetFeed I is smaller and lighter than any of the multiple-bin sheet feeders I reviewed. Getting started is easy. Setup, installation, and my test

FACT

Genesis Technology Inc. 30963 San Benito Ct Hayward, CA 94544 (415) 489, 3700 List Price: \$799.00 quires: HP Laserjet or Canon laser In Short: A small, light, easy-to-assemble sheet feeder for your laser printer; it gives you one additional bin, holding up to 500

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Zivad Inc.

JetFeed I

Paper, Jet 400

Unlike the MF 850 and the MF 830 laser feeders (reviewed here), the PaperJet 400, from Ziyad (priced at \$1,495), doesn't sit adjacent to the Laserjet: it sits underneath it. Its two paper bins face the front of the combined feeder/printer, directly beneath

print run took less than 15 minutes.

In contrast to the other feeders I reviewed, the JetFeed I has no parts to assemble. You snap the unit on to a pair of stubs on the manual paper feed chute of the printer, then connect it to the computer and printer with serial cables: finally. you adjust the width of the feeder's paper bin and load it with paper.

Like the other feeders I reviewed, the JetFeed I sits between the computer and the printer so that it can locate and execute the bin selection codes and then strip them out before they reach the printer. The JetFeed I accepts only two feeder codes; one to select the feeder's bin, and the other to select the printer's internal paper tray. You insert these commands into your documents on lines by themselves.

Two banks of DIP switches, accessible from the rear of the installed JetFeed I, allow you to set baud rate for serial interface and to select either Auto Feed or Normal mode. In Auto Feed mode, all paper is fed from the feeder's bin, and you are not allowed to select the internal tray by inserting feeder codes.

Since its single bin holds up to 500 sheets of 16-, 20-, or 24-pound paper, the JetFeed I is ideal for handling large print runs without having to change paper too often. Most users will probably keep letterhead stationery in the printer's internal tray and plain bond paper in the feeder.

Of course, the adjustable feeder bin also handles various sizes of envelopes, and you could handle an entire mail-



The JetFeed I is small, light, and easy to assemble. The single-bin feeder has a 500sheet capacity and is designed for users who want to do large print jobs unattended.

ing-printing both envelopes and paper-with the JetFeed I, as long as the document didn't require two kinds of paper. In that case, you'd have to print the envelopes as a second job.

If the paper jams or the feeder runs out of paper, a small LED blinks and printing stops. When you correct the problem, the JetFeed I resumes printing with no loss of data-if you have not turned off the unit I simulated both of these errors to check the JetFeed I, and it performed as claimed.

All in all, the JetFeed I is an excellent sheet feeder for those who don't really need more than one extra bin for letterhead or envelopes. It has fewer parts than the other multiple bin feeders I reviewed, requires less in the way of installation and maintenance, and is the least expensive laser sheet feeder we've found -Phil Wiswell

the printer's internal paper tray. Forms from all three bins feed through the Paper-Jet's paper-feed mechanism, which travels up the rear of the printer and delivers paper to the Laseriet's manual feed chute. An en-

velope bin sits adjacent to this chute. Thus, when combined with the Paper-Jet, your Laseriet requires only a few more inches of depth on the table. The height of the Laseriet increases by about 10 inches. Overall, this design is more aesthetically pleasing than that of the BDT feeders. It looks more like a single unit than a conglomerate of widgets, though not as elegant as the Laserjet 500 Plus printer.

Although every PaperJet 400 comes with both a serial and a parallel interface port, you may not use both. The unit is or-

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Paper Jet 400 Ziyad Inc. 100 Ford Rd, Denville, NJ 07834 (800) 922-0262 (201) 627-7600 List Price: \$1,495 Resultes: HP Lascrict or

Requires: HP Lascriet or HP Lascriet Plus. In Short: A capable, simple-to-operate sheet feeder for laser printers, with two paper bins that each have a 175-sheet capacity and one envelope bin.

CIPCLE 007 ON READER SERVICE CARD

dered as either serial or parallel; each use a different logic board. In theory, I don't like this limitation, but, in practice, I suppose it doesn't matter. The cable from the computer attaches to the Paperlet, and the building and execute feeder commands before commands and execute feeder commands before treach the printer, as with the BDT models. Initial setup and installation procedures on technical knowledge and should not take longer than 20 minutes.

The Paperlet's documentation, consisting of two manuals and several looseleaf bulletins, is clearly superior to that of the BDT feeders. The first manual, the Operator's Guide, walks you through installation and problem solving with clearly written text and good illustrations.

The second manual, the CheadSheet, leads you through setting up and using the PaperJet/Laserjet combination with six popular applications. DisplayWrite 3, MuliMae. MuliMae Advantage, Samna Word III, WordPerfect, and 1-2-3. For each program, it gives you step-by-step instructions for printing a two-page letter and printing a letter with its envelope.

The CheatSheet is an excellent document for helping you get started, assuming you use one of these applications. But even if you don't, just reading through the instructions on setting up one of these programs is probably enough to help you figure out how to make your program work with the Paper1eULaserjet combination. Of the many Software Application Bulletins included in the box, one 12-pager describes in detail how to modify WordStar.



The PaperJet 400 sits underneath the Laserjet so that its two bins with a capacity of 175 sheets each add only a few more inches of depth to the space needed for the printer and feeder.

Versions 3.30 or 3.31, for use with the Laseriet as a full-line printer.

Embedding codes in your documents to command various pages to be printed upon the three pager bins or the envelope bin is easy and straighforward. Each life easy and straighforward and the post of the easy and straighforward and the constant and the past of the easy and straighforward. Each life so the easy and straighforward the past. As the easy and the easy and the past and the past of the easy and the past of the easy and the past of the easy and the e

The six tray commands are numbered 0 brough 5: manual paper feed, Twy 1, tray 2, tray 3 (the internal paper tray), tray 4 (the envelope bin), and continuous feed. This last option is particularly useful for large print tuns. It feeds from tray 1 until empty, then switches to tray 2 until empty, then switches to tray 2 until empty, then switches back to tray 1 until or two things happens: either no tray contains

paper, or the print run is completed.
You may execute four other feeder codes; these tell the printer to expect standard 66-line/11-inch forms, 84-line/14-inch forms, Or 60-line/255-millimeter forms. If you change paper length within a document, you will also have to issue the correspondent

■ The PaperJet 400 is simple to operate relative to the complex jobs it must perform.

ing paper-length feeder code. A nifty "banner page" feature allows you to describe all your bin and paper-length changes on the first page of your document so that you don't have to locate all the page breaks and insert codes after them.

The Paperlet 400 is simple to operate relative to the complex jobs it must perform, and anyone with Lasergiet experience should have little trouble either installing or operating the unit. The Paperlet 400 does what it says it will—no paper jams occurred during testing—and the company provides excellent telephone support.

MAKING YOUR CHOICE

The six-bin MF 830 from BDT, although the most expensive sheet feeder reviewed here, is great for certain applications and

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SHEET FEEDERS

Product Manufacturer	PeperJet 400 Ziyad Inc.	MF 850 Leter Feeder BOT Products Inc.	Laser Feeder BDT Products Inc.	HP Laserjet 500 Plus Hewlett- Packard Co.
List price	\$1,495	\$1,695	\$4,495	\$4,995
No of paper bins	2	2	6	2
Bin capacity (sheets)	175	200	200	100
Uses internal bin	•	•	•	0
Envelope bin	•		•	0
Envelope bin capacity	75	50	50	N/A
Table space required (inches)	19×25	19×32	20×46	19×19
Sensi port	•	•	•	•
Parallel port	•	•	•	•
Collates in correct order	•	•	•	0

setting—for example, a law office that use different lettered for each atterthead for each piper tray hold a tool of 1,300 sheets—far more than any other feeder—enabling you to handle large print runs unsattending for forms flipper, standard on all BDT feeders, allows you print runs to state for sistened to state the properly collated page-number order. But since it costs more than the other sistened its sistened it costs make sure that you really need it six bins before vote consider braving eight in the feeders, make sure that you really need it.

●-Yes ○-No N.A-Not applicable: does not have this feature.

BDT's two-bin MF 880 delivers the same features and performance as its big brother, the 830, but it has a more reasonable price tag. Most users will find three paper bins (counting the internal paper tray) plenty. Typically, you might keep letterhead in one bin, plain paper in another, er, a third type of form in another, and your company letterhead envelopes in the special envelope bin. Multiple-page letter mass mailtings, and multicolored documents are the most likely uses for this unit.

The Paperlet 400 offers features and performance pretry much identical to those of the MF 850, for \$200 less; however, its two extra bins hold only 175 sheets each, as opposed to 200 sheets on the MF 850. Still, it holds more envelopes and takes up less table space. Another point in favor of the Paperlet 400: it sits beneath the laser printer, so that the internal paper tray and

the two paper bins on the feeder are stacked above one another. I'm tempted to call the JetFeed I (see

sidebar "Super Little One-Shi Feeder . The Feed I From Genesis Technology") a "personal" laser sheet feeder because it has only one bin, which you can adjust for different sizes of paper and envelopes. This single bin, larger than any single bin on the other feeders reviewed, holds 500 sheets. Soil your application requires heets. Soil you the expensive MF 820 when the size of the same form loaded for larger prix runs, only the expensive MF 820 when the size of the size of the size of the size of the same form loaded for larger for the size of the size

The HP Lascriet 500 Plus laser printer has two bins, so i performs the same function as does the leffeed I, except that you may not load envelopes into the thind the may not load except that the performance to have been a performed that the performance of the

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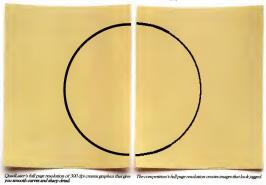
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When it comes to print styles, the 5010 converts to your personality. Choose from a variety of fonts. Insert up to four font cartridges at once, and vary type styles within the same document.

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nostic readout speaks your language, with a 32 character LCD that informs you of printer status in plain English. Pass The Limit. Genicom designed the

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TECHNOLOGY

Pluses for Your HP Laserjet

hen it was first introduced in 1984, Hewlett-Packard Co.'s Lasegiet made fast, quiet, clean printing a reality for PC users with advanced printing needs and money in their budgets. It gave corporate users a sharedresource printer with more speed than a dot matrix machine and the quality of a daisy wheel, minus the noise.

Despite its inadequate paper capacity (recently cured in the 500 Series), the Laserjet found its niche. Operating the printer in that environment, however, caused initial chaos. The Lascrjet was designed to be a standard unto itself. Beyond getting it to perform the simplest tasks, no one seemed quite sure how to get what they wanted from it.

PC users blanched when first presented with the Laserjet's escape codes. These printer commands, used to enable bold-face, italic, and underline character enhancements, as well as font selections and page orientation, more closely resembled ancient runes than any escape codes they'd seen before.

Another limitation was the fact that the number of fonts you could use depended on which cartridge you bought. And compounding the problems was the situation

that applications software did not as yet understand the Laseriet either.

Hence the chaos. The printer had great capabilities, if only you could find out how to use them.

But despite the difficulties users experienced finding out how to produce fancy results with the HP, the basic attributes of the printer—quality copy and rapid through-put—were impressive. In fact, the Laserjet redefined printing speeds in the microcomputer environment, pushing ratings from characters per second to pages per minute.

So it sold. And it sold.

And its old.

And—lucky for most Laserjet ownen—the vigrous sales inadvertantly created a new outage industry dedicated to
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horizont for making the most of your
Laserjet, You'll labon to doubt be interested in—and perhaps covetous of—HPS
newest addition to the Laserjet does II, reviewed
by Bill Machinos in "Laser Primer Technology; Great Performance for Under
horizont for the control
horizon

Many of the new lowand medium-priced laser printers meet or exceed the capabilities of the pioneering HP Laserjet. But don't spend too much time regretting your early purchase of an HP. A new cottage industry has been busy developing ways to help you tune up, not throw out, your printer. FONTS FROM IF Hewlett-Packard has not been unresponsive to user needs. To augment the sole Courier from it built into the Laserjei, it sells a collection of Laserjei font cartridges. These plug-in ROM modules add an ascortment of forts in various sizes and styles. Most desktop publishing programs prefer the B cartridge for its collection of Times Roman and Hevetica.

If you own the Laserjet Plus, you'll want to consider purchasing HP's Soft Fonts, font definitions supplied on floppy disk. You can download them into, and access them from, the expanded memory area in the Plus version.

YOUR SOFTWARE AND THE HE Many of your favorite pragrams, such as WordSur, Version 3.31; Kwitze, Merzos Word and Windows Write, and PC PaintBrain Place, may already know how to use the Laserjet property. My personal favorite program is Windows Write, which was the same of the program is Windows Paint as part of the package, and Paint also knows how to handle the Laserjet. In fact, any applications of the Windows printer in the Windows and uses the Windows printer seeks will work in the Windows.

But if your software does not support the Laseriet, you'll have to know a few things before you'll be able to print with at least passable results. First, the Laseriet does not print 66 lines on an 81/2- by 11inch page. Rather, the printable area of its photoconductor produces only 60 lines per page. When your software reaches the last printable line, it must use a form feed to terminate a page, not multiple line feeds. (If you are not aware of both these requirements, you can end up with some amusing, albeit useless, results. For example, if your software is set for a 66-line page and uses form feeds, the Laseriet will automatically eject the page when it reaches its 60line limit, after which your program will print the few remaining lines on a new sheet and then eject it. Alternately, if the program's set for a 60-line page but no form feeds, you'll notice that the top and bottom margins become erratic until headers and footers for adjacent pages appear on the same sheet.)

Note: If you're waiting for your upgrade from WordStar Version 3.30, to

3.31, which does support the Laserjet, you can temporarily trick your current version into working with the Laserjet by installing the printer as a half-line printer. With either version, it's important to select "Use Form Feeds" from the Print menu.

SOFTWARE TO HELP THE HP The Laserjet-spurred cottage industry is most active in the software arena. Many vendors are getting into the act of helping out Laserjet owners.

 To surmount Fontasy's one-page limitation, you can link image files to make longer documents.

Perhaps the largest supply of software fonts for the Laserjet Plus is currently available from VS Software. The sampling the company submitted for our inspection included variations of all the fonts usually found in Apple's LaserWriter Plus (Courier, Times Roman, Helvetica, New Century, Chancery, and so forth), and my hard disk gave up about 2 megabytes of storage to the differences in style, shape, and size for each of the font types. VS Software should have another 200 or so fonts available by the time you read this. including some for commercial applications. You can download any of these fonts into the Laseriet Plus, or you can modify them (or create your own) with VS Software's FontGen IV Plus.

Forti-generating software like FomtGen
VP less can also help you create special
symbols and images that would normally
be tool to lege to define as single claracter.
the software in the following way. Since a
mall blank space always appears between
the physical bottom of a character (called
the chin) and the point at which the line
space (called the beauty) keeps successive
miss of type from coldiding top to bottom,
to the beauty levels are to the beauty levels
to the beauty levels are to the color of the color of the
overall design. If you print these segments of a larger
overall design. If you print these segments

in adjacent character positions and on successive lines, you've created a printed

For creating single-page masterpieces, Prosoft's Fontany, Version 2, is worth a close look. The base package includes 28 fonts, and some 250 others are also avail as lee (some are proportional), as also lee (some are proportional), as well as several amusing examples of clip art, You can draw frechand (producing truly round circles on both the printer and the screen,) fill platterns, modify images (by inverting and rotating them), and define 33 "soft keys."

Since the area of a printed page exceeds the boundaires of your display. Prosoft created Fontary with both horizontal and vertical scrolling capabilities. The forst series wishle on-screen, and because Fontary works with a variety of printers, it does internal font composition that you can output to either a Laserjet or a Laserjet Plus. To surmount Fontary's one-page limitation, you can link image files to make longer documents.

Microsoft Word can access your Laserjet, but it confines you to using the typefaces from whatever font cartridges (if any) you have. SoftCraft's FancyWord gives Word a bit more character.

FancyWord is really a disguissed text formatter, but since you call it in with Microsoft Word's Library command, the disruption between using the word precase and the formatter is not so great as it would be with a standation formatter. Word picks up the font types from FancyWord's printer driver, so you don't have to give the printer any elaborate instructions. An optional forn editor less you design your forsts, including any special symbols you might need.

in addition to FancyWord, SoftCraft also markets Fancy Forn is a standation text formatter that works with any ASCII lext file. But, as with any formatter, you must embed its own formatting instructions in your text to produce finished copy. Of course, if you try to select any of SoftCraft's graphics frosts (instead of hose already resident in your Laserjet), your printing slows to a crawl.

You can overcome this problem if you own a Laserjet Plus by using Laser Fonts, SoftCraft's downloadable font series. Fancy Fonts can access these fonts instead of trying to use its own.

Other available in the variable in the Straight formation were available in the straight formation with a straight formation at learning to the straight formation at learning to the straight formation at learning the straight format learning the straight formation at learning the straight format

position.

One problem you may generally run into while using TSRs such as LuserWare is that they are sometimes incompatible with each other. And each one you load lowers your available memory until, perhaps with two or three installed, you may find there's no room for your text editor.

Polatis Software's Print Merge comes in either TSR or standard program puelages. Polatis also offers separate software for forms (Fermis), labels (Laberhouker), and even symbols and clip art (Symbol Sheet and Polatis Carneh). Il your feel with on WordSur, a version of Print Merge will replace Mullerge, (One of the original polatis and polatis Lauerje Esup Utillity, while Jows you to bypass the usual HP hierogyphies in Favor of a mena-oriented and polatic polatis Lauerje of a mena-oriented and polatic polatis Lauerje of a mena-oriented and polatic polatis Lauerje of a mena-oriented oriented orien

tion.) If you're a specialty writer with complex formatted documents to print, you'll find Beaman Porter's PowerText Formatter a dream come true. PowerText understands the formatting you'll need for screenplays, television scripts, and even column work for newspaper output, in addition to highly formatted document elements like tables of contents, indexes, and bibliographies. I know three or four professionals that use it, and, after some initial grousing over the new tricks they had to learn, they've raved about the help it offers. PowerText also supports Soft Fonts on the Laserjet Plus.

One of the better features of PowerText is transcro capability. You can use it to create style sheets that respond to embedded commands that will adjust your text to the correct position within your document and then assign it to a macro name. Using



HARDWARE

Collaser AVN Inc. P.O. Box 2202

Provo, UT 84603 (801) 375-8533

List Price: \$34.50

Requires: Any printer with a Canon engine.

In Short: A plastic catch-bin that replaces
the output tray on your Laserjet. Printed
sheets enter it in reverse order, thus collating

your job. CIRCLE 665 ON READER SERVICE CARD

JATO Office Automation Systems Inc. (Oasys)

8352 Clairemont Mesa Blvd. San Diego, CA 92111 (800) 732-4589

(800) 732-4588 (in Calif.)
List Price: \$1,695, including 1.2 Mbytes
RAM, Oasys Pyramid.
In Short: Laserjet conversion board that

adds Diablo, Epson, NEC, and Qume printe emulation and 256K more memory for graphics and Soft Fonts. It's also 25 percent chaper than Hewlett-Packard's supgrade. CRCLE 600 ON PEACE SERVICE CAPO.

Jinser Plus AT

P.O. Box 50690 Palo Alto, CA 94303 (415) 493-1980

(415) 493-1980 List Price: \$1,179, including 2 Mbytes RAM, scauner controller, and printer con-

In Short: This plug-in memory and Laserjet controller board can be accessed by software Graphics are composed within the board's own memory at computer operating speeds rather than in the Laserjet or Laserjet Plus, which decreases printing delays, in some

cases, by a factor of ten. CIPCLE 646 ON READER SERVICE CAPO

tion.

Laserjet Font Cartridges Hewlett-Packard Co. Bolse Division

P.O. Box 15 Boise, ID 83707-0015 (208) 323-6000 List Price: \$225 to \$400

Requires: Laserjet, Laserjet Plus, or Laserjet 500 Plus. In Short: ROM-based font definitions that

jet 500 Plus. In Short: ROM-based font definitions that plug into cartridge slots on HP Laserjet and Laserjet Plus. CRCLE 842 ON FEADER SERVICE CARD

PaperMax 500 Sterling Computer Products

1459 Industrial Ave. Escondido, CA 92025 (800) 227-5525 (800) 523-4982 (in Calif.)

(800) 523-9982 (in Caint.)
List Price: \$495
Requires: Any Canon-engine-based laser
printer, font system, and Express command

inguage.

In Short: A hardware conversion for the Laserjet or Laserjet Plus that gives it 500-sheet

serjet or Laserjet Plus that gives it 500-sh capability equal to the Laserjet 500 Plus. CRCLE 640 ON READER SERVICE CARD

2-Mbyte Upgrade Kit Hewiett-Packard Co. Boise Division P.O. Box 15 Boise, ID 83707-0015

(208) 323-6000 List Price: \$2,495, including 2-Mbyte m

ory, manual, Laserjet Plus functionality, dual I/O ports. In Short: This upgrade for the Laserjet con-

verts an original machine into a Laserjet Plus with more memory for graphics and Soft Fouts. ORCLE 660 ON READER SERVICE CARD

PowerText's style sheets and macros, you can compress the physical labor of formatthing documents into a one-time proposithing documents into a one-time proposimore forther definitions than any two Laseriet

HARDWARE ENHANCEMENTS Since its introduction on Apple's original LaserWriter, PostScript, the page-definition language from Adobe Systems, has caught on like wildfire. You have quite a few reasons to wish your Laseriet were

that most renditions of PostScript include more font definitions than any two Laserjet cartridges.

One way to get the advantages of Post-Script and still leave your Laseriet is to turn

Script and still keep your Laserjet is to turn to the Laser Connection. Its PS Jet and PS Jet Plus boards give you PostScript advantages by making your Laserjet a Laser-Writer clone. (See sidebar "PS Jet: Transforming Your HP with PostScript.")

■ HP LASERJET PLUSES



FACT FILE

SOFTWARE



Fancy Fond SoftCraft Inc t6 N. Carroll St., #500 Madison, WI 53703 (608) 257-3300 List Price: \$180 res: 192K RAM. two disk drives, DOS 2.0

ort: A standalone text formatter that works with any ASCII text file. Not copy pro-

tected CIFICLE 660 ON READER SERVICE CARD



SoftCraft Inc. 16 N. Carroll St., #500 Madison, WI 53703 List Price: \$140 Requires: 192K RAM.

two disk drives, DOS 2.0 or later. In Short: This text formatter can be run from Microsoft Word and lets you access additional SoftCraft font definitions. Not copy pro-

tected CIPCLE 649 ON READER SERVICE CARD



Fontary, Version 2 7248 Belle Aire Ave. P.O. Box 560 North Hollywood, CA 91603 (818) 765-444

List Price: \$69.95 Requires: 256K RAM (to print partial page or 512K RAM (to print full page), one disk drive, DOS 2.0 or later.

In Short: A graphic text formatter that lets you create page-size compositions with mul-tiple fonts and or graphics clips. Not copy

CIPICLE 662 ON READER SERVICE CARD

FontGen IV Plus VS Software P.O. Box 6158 Little Rock, AR 72216 (501) 376-2083 List Price: \$250 res: 256K RAM

two disk drives, DOS 2.0 or later. Hard disk recommended In Short: You can customize or create font definitions with this huge assortment of Laserjet Plus's Soft Fonts and font editor/gener-

stor. Not copy protected. CRCLE 845 ON READER SERVICE CARD



613 W. Valley Pkwy. Escondido, CA 92025 (800) 338-5943 (800) 23t-353t (in Calif.)

List Price: \$149 Requires: 256K RAM, two disk drives, DOS 2.0 or later

In Short: This sof

CLE 600 ON READER SERVICE CARD



Polaris Softwa 613 W. Valley Pkwy. #323 Escondido, CA 92025 (800) 338-5943 (800) 231-3531 (in Calif.)

List Price: \$124 Regulres: 256K RAM, two disk drives, DOS 2.0 or later

In Short: Label-making software. Not copy ICLE MIN ON READER SERVICE CARD

SoftCraft Inc. 16 N. Carroll St., #500 Madison, WI 53703 (800) 351-0500 (608) 257-3300 List Price: \$180

Requires: 128K RAM, two disk drives , DOS 2.0 or late In Short: Downloadable Soft Fonts-style font definitions for the Laseriet Plus. Not copy protected. CRCLE 601 ON READER SERVICE CARD



LaserWare **SWFTE** International

P.O. Box 219 Rockland, DE 19732 (800) 237-9383 (302) 658-1123

List Price: \$99.95 es: 45K RAM (with the Laserjet) 46K RAM (with the Laseriet Plus), one disk drive, DOS 2.0 or later.

In Short: A memory-resident font and printer-management utility for the Laserjet se

Not copy protected. CRCLE 847 ON REAGER SERVICE CARD



Polaris Crunch Polaris Software 613 W. Valley Pkwy. #323 Escondido, CA 92025 (800) 338-5943 (800) 231-3531 (in

Calif.) List Price: \$49.95 Regulres: 256K RAM, two disk drives, DOS 2.0 or later

In Short: A utility that optimizes grap images for the Laserjet by removing unused areas (white space) surrounding the actual

image. Not copy protected. CIPCLE OFF ON PEADER SERVICE CARD

If you don't want to spend the nearly \$3,000 that PS Jet costs, you can add what amounts to overdrive to your Laserjet with Tall Tree Systems' Jlaser Plus AT board. Actually this board is a 2-megabyte JRAM board with a Jlaser daughterboard attached that installs in your PC AT (there's an XT version, but you should really avoid using the 4.77-MHz XT and possibly even the 6-MHz AT if you're delving into high-end

page composition). The Jlaser board is a direct image capture/printing system that connects to a ing both through device drivers (the Laser-Jet connection is through an independent serial port on the Jlaser board).

Although the Jlaser board has been available for almost a year, it was not until recently that the software appeared to make it a worthwhile investment. Tall



Polaris Laseriet Setup 613 W. Valley Pkwy. Escondido, CA 92025 (800) 338,5943 (800) 231-3531 (in

Calif.) List Price: \$25 Requires: 256K RAM, two disk drives,

DOS 2.0 or later. In Short: A versatile program you can use to configure your Laserjet prior to printing. Not

py protected. IRCLE 666 ON READER SERVICE CARD

Polaris Print Merg m-RAM resid Polaris Software 613 W. Valley Pkwy. #323 Pateri Pro/May Escondido, CA 92025

List Price: \$124

Colif)

(800) 338-5943 (800) 231-3531 (in Requires: 256K RAM, two disk drives,

DOS 2.0 or later In Short: An installable WordStor overlay file that permits access to the Laserjet's font capabilities. Not copy protected

CIPCLE 666 ON READER SERVICE CARD

PowerText Fore un Porter Inc. 417 Halstead Ave. Harrison, NY 10528 (914) 835-3156 (914) 835-3010 List Price: \$89.95 (\$5 oing and handling)

es: 256K RAM, two disk drives, DOS 2.0 or later. cialized writing, an excel-In Short: For spo lent standalone text formatter with macro capability. Its commands are complex. Not

copy protected. CIRCLE MA ON READER SERVICE CARD



(800) 231-3531 (in Calif.) List Price: \$149 Requires: 86K RAM, two disk drives, DOS 2.0 or later (does not function with DOS 2.1).

In Short: A TSR program that permits access to the Laserjet's font capabilities. Not my protected

CIPICLE 664 ON READER SERVICE CARD Soft Fonts



Hewlett-Packard Co **Boise Division** P.O. Box 15 Boise, ID 83707-0015 (208) 323-6000 List Price: \$200 Requires: One disk

drive, Laseriet Plus, DOS 1.0 or later. In Short: Disk-based font definitions that are downloadable into Laserjet Plus only or Laseriets that have been modified with addition al memory to emulate the Laserjet Plus. CIRCLE MAT ON READERSHRAFT CARD

Symbol Sheet . List Price: \$49.95

Polaris Software 613 W. Valley Pkwy. #323 Escondido, CA 92025 (800) 338-5943 (800) 231-3531 (in Calif.)

Regulres: 256K RAM, two disk drives, DOS 2.0 or later. In Short: TSR or standard software proc symbols. Not copy protected.

Tree supplies a short program that lets the scanner, your computer, and the Laseriet act as an extremely expensive copy machine. You don't realize its full potential until you add programs like PC Paintbrush Plus, which will permit you to capture, edit, and print a scanned image, or Ventura

Publisher, which will incorporate that image into text.

You can achieve the identical result with a standard printer port for the Laserjet and the normal Canon interface board, but the added time is a concern. With the Jlaser system, the bulk of composition takes

place in the JRAM's memory and not in the Laseriet. A full dithered image occupying about 60K (the original PC Paintbrush Plus file size was over 1 megabyte before it was incorporated into Ventura Publisher) took under 4 minutes to print with the Jlaser. I pulled the plug after 15 minutes of waiting for the same printout using a standard serial interface.

Installing the Jlaser involves simply plugging it into the AT and adding a small (and simple) I/O conversion board to the Laseriet. The JRAM manual 1 received was somewhat confusing. It dwells on hardware addresses, with conflicting information for EGA boards and Microsoft's Bus Mouse among others. The manual explains alternatives in terms that the hardware expert will grasp more easily than will most users, but the Tall Tree technical staff is superb. They also promise to put out a revamped manual. The separate manual for the Jlaser daughterboard is much clearer.

HARDWARF UPGRADES From a hardware standpoint, perhaps the least you can do to improve your Laserjet is to upgrade it to Laseriet Plus status. Then you'll be able to use the ever-increasing number of software fonts being produced.

Hewlett-Packard offers a Laseriet Plus upgrade package, the 2-Mbyte Upgrade Kit. Its board will make your Laserjet functionally duplicate the Plus version, but it does not give you a parallel port.

Oasys offers the JATO board for Laserjet owners interested in upgrading to the Laseriet Plus, and it also adds Diablo 630. Epson FX-80, NEC SpinWriter, and Qume Sprint 11 printer emulation, 256K more memory than a standard Plus (640K total), and Oasys's Pyramid Printer Control system (this last is a slightly dubious extra predicated on third-party support of the system). The JATO board is also 25 percent cheaper than the HP board. (JATO, by the way, stands for for iet-assisted take-off.)

The main proviso for both of these boards concerns installation. Hewlett-Packard recommends that you take your printer into an authorized HP service center (read that to mean "preserve your warranty") for its upgrade installation. Oasys prefers that you send the company your





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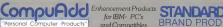
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PS.JET: TRANSFORMING YOUR HP WITH POSTSCRIPT

If you own a Laserjet or other Canon-engine printer, you may need the PS Jet board for more-complex printing via PostScript.

Hooked on page-composition software but limited by your printer? Fantasize about little elves transforming your HP Laserjes or other Canon-engine printer into an Apple LaserWhiter? Dovinessor of PostScript dance in your bead? The Laser Connection's FS Jet and FS Jet Plus can make your dreams come true, endowing your printer with Adobe Systimum of the printer FostScript and enabling your printer without requiring you to learn a new proeramming language.

gamming subgouse.

In the property of the prop

grams.) The PS Jet or PS Jet Plus controller board replaces the board in the top part of your printer, offering the same capabilities as the more expensive Apple Laser-Writer or LaserWriter Plus, the Post-Script-based wonder machine that PC Magazine judged one of the best products of 1985 (see "The Best of 1985 (and Some of the Worst), "Volume 5 Number 1). The basic LaserWriter includes four fonts (in Apple parlance, a font is a typeface, scaleable from 7 to 127 points and adjustable to italics and bold weights): Times, Helvetica, Courier, and Symbol. In addition, PS Jet Plus gives you Bookman, Palatino, New Century Schoolbook, and Zanf Dingbats typefaces.

Installing PS Jet or PS Jet Plus (which incidentally gives you more fonts than PS Jet and the capabilities of the LaserWriter Plus) isn't a breeze: I broke off a screw during the 40 minutes it took me to lobotomize my HP Laserje Plus. But the screw didn't seem to matter in the end, and the instructions are some of the clearest and most comforting I've come across in my travels through the often Daliesque world of laser printer docu-

mentation.

Once you've installed PS Jet or PS Jet Plus, your printer looks unchanged—except that it has different indicator lights and connectors. The new connector pan-



PS Jet Plus
The Laser Connection
P.O. Box 850296
Mobile, Al. 36685-0296
(800) 245-5477
(205) 633-7223
List Price: PS Jet. \$2,995: PS Jet Plus.

\$3,495.

Requires: Any laser printer with a Model 1
Canon engine.

In Short: Pricey but worthwhile controller boards for Canon-engine-based printers. They endow printers with PostScript ability and enable them to produce fancier text and graphics.

gruphics. Circle **641** On Reader Service Card

Tops Print Centram System Inc. 2590 Ninth St., #220 Berkeley, CA 94710 (415) 644-8244 List Price: \$189 Requires: 76K RAM (withou

List Price: \$189 Requires: 76K RAM (without Tops Network software) or 64K RAM (with Tops Network software), plus additional 100K RAM for Tops Network software; one disk drive; Tops PC AppleTalk card; DOS 2.0 or later.

In Short: A utility that translates files sent over AppleTalk into or out of PostScript. Not copy protected. ORCLE MACON PLACES SERVICE CARD el sports an innovative thumbwheel, which stands in for the more usual DIP switches and lets you select the type and the speed of connection you want between printer and computer just by rotating it to the right number.

You can connect the printer to your computer with a serial or a parallel cable or even to the AppleTalk network (providing that you obtain one of several AppleTalk boards for the computer). You then have to reinstall each of your applications programs that you want to use with PostScript, provided, of course, that each one has a PostScript diverse.

If one of your applications programs doesn't support PostSerfic, you can use Tope Print, a utility program from Contram Systems, the praveyor of the Tops network for mixing Macintoshes and Postson and papel Baystems. Tope Print will strip the unnecessary codes out of a PostScript file for seading it over Application will translate Epono-ayle files into PostSerfig to the Ify for a sentled on the Post PostSerfig file for senting PostSerfig for the Ify for a sentled produced to the PostSerfig for the Ify for a sentled produced to the PostSerfig for the PostSerfig for the Serfig For Serfig F

Although the original version of PS let forced you to choose between Post-Script and your printer's resident controller, by the time you read this, both PS let and PS Jet Plus will offer emulations of Hewlett-Packard's PCL and HPGL in ROM. Thus you can continue to use your printer as a Laserjet and worn't have to worry about throwing away or reformatting your existing files.

PS Jet and PS Jet Plus may seem expensive at \$2,995 or \$3,495, respectively, but they're worth every dollar if you've already invested in an HP Laserjet or other Canon-engine printer and have since developed the need for morecomplex printing.—Stewart Alsop



Extending the HP Laserjet Font Library

nt generators like VS Software's FontGen and ProSoft's Fonsy add tremendous possibilities for dressing up documents oduced on an HP Laserjet. Here is a sampling of their fonts. We've also enlarged samples generated by Fontasy on a laser printer and on an Epson FX-85 dot matrix to show the different in quality.

FontGen

Fontasy Olde English Condensed (12-paint)

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IBM PC Stendard Foot

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FLOWCHARTS

Finallyl An on-screen flowchart procmakes you do most of the work.

interactive EasyFlow is a powerful full-screen graphics program dedicated to flowcharts and organization charts. With this program you can quickly compose charts on the screen. More imthey are always up to date.

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HP 7475A (& compatible) plotters. Can essor that knows about flowcharts - not be used with ANY printer when nonjust another "screen draw" program that graphic (character) output is acceptable · All standard flowcharting shapes included . Most shapes supplied in large,

medium and small sizes . Extensive manual (100 + pages) includes many examples . Context sensitive "help" facility provides immediate assistance at any time . Any number of titles can be portant, you can easily modify charts so placed on a chart . Commentary text blocks can be placed anywhere in the chart . Fast: written in assembly language . Plus many more features than we can mention here

> Requires at least 320K memory, DOS-2 or higher and an IBM or Hercules compatible graphics card. On EGA, full 640x350 resolution is used.

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The sample screen display shown below is typical of what you see while editing a chart. Other screen displays are provided for entering littles, changing

options, getting "help" and so on. LaserJet and LaserJet Plus. Works with STATUS BAR (not to be CHART WINDOW gives an overview of your chart; this example shows the "normal" view. "Close-up" view shows a smaller part of the chart in more detail. "Wide-angle" view confused with a wet bar) tells you what Interactive EasyFlow is doing at all times. shows a larger part of the chart all reduced size TEXT/MESSAGE WINDOW used to enter I is estrovalid 77 user text and to display essages from Interactive CURRENT SHAPE WINDOW - shows the content of the current flowchart shape (the one under the SHAPE CURSOR) in complete

HavenTree Software I imited P.O. Box 1093-P Thousand Island Park, NY 13692 Information: (613)544-6035 ext 49

SHAPE CURSOR shows where you are in the chart. Cursor keys move it around; chart window scrolls if you run off the edge of the HP LASERJET PLUSES

printer (without the toner cartridge installed, please) and let it install the JATO board. If you're comfortable installing disk drives or memory chips in your computer, you'll find that installing these boards yourself will take about 2 hours (including phone calls for help).

 Multiple-bin feeders are handy, but you give

up some speed for their capacity and versatility.

HARDWARE ADD-ONS The HP Laseriet has two design flaws that weren't HP's fault. Because the company chose to base the Laseriet on the Canon engine (the only viable alternative at the time), you are stuck with a maximum paper capacity of only 100 sheets. In addition, your output pages stack one atop the other in reverse order, requiring you to collate the pages

Upgrading to the Laseriet 500 series with its 500-sheet capacity offers one solution to paper quantity problems, and most desktop publishing software will let you specify collated order for your output (in which case the copy is printed from last page to first). But with your bread-andbutter applications programs, and especially in network use, using the flawed paper-handling capacity of the Laserjet can drive you nuts.

Adding paper capacity is not simple. but it can be done. BDT Products offers several varieties of multiple-bin sheet feeders for the Laseriet, Essentially, the bins are attached at the manual paper feed tray. (See Phil Wiswell's "Laser Printer Technology: Sheet Feeders Multiply Your Printing Options" on sheet feeders in this issue for more information about the latest products and how they perform.)

Multiple-bin feeders are also handy when you need to use different types of paper, such as letterhead followed by second sheets and/or envelopes. But you give up some speed for the capacity and versatil

SHARING SOLUTIONS

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to one printer . Up to 256K memory · Seriel or possibil • From \$395



sent to the unit selects the destinction. All ports can communicate to only other part concurrently. Features include configuration menu, form feed, initialization strings, priority, status, conceltimeout disable, fruet nonel display, and many more PORTER

he FOLLER is a versatile unit for part expansion. It is used widely for data collection, telecommunications, factory automotion, and multiple printer control. Data can be received and transmitted simultaneously on all units and is routed by command. Other mands include walt, go, copy, and clear buffer. It is aften used on an odd up to a local arms network



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CIRCLE 307 ON READER SERVICE CARD

perhaps as an interpreter for them as well). you might track down a copy of A Working Guide to the HP Laseriet and Laseriet Plus Printers by Alfred Poor (1987, New York Communications Systems). Poor's command of the subject matter is impressive. He's even included some practical tips for a variety of applications.

tv. A software-initiated escape sequence

activates the Laserjet's manual feed tray,

and the changeover from the standard tray

will delay the printing. One small delay

may not be important, but cumulative ef-

fects can reduce the output rate by as much

Max 500 is an alternative solution. Paper-Max 500 is a 500-sheet tray for the Laser-

iet, but it requires some modifications to

the printer. Sterling prefers that you send

the company your printer, and it will add a

new shell at the base to accommodate the

simple to the sublime. In its easiest form,

AVN's Collaser provides a collator for the

Laseriet that is merely a replacement exit

tray extending down from the printer. As each sheet leaves, it falls into the vertical

bin in reverse order. Alternatives increase

in complexity to flipping and turning devices, and as their sophistication increases so does their reliability. Various models are available from AVN and BDT Prod-

peared for the Laserjet so far are predicated on a specific printing arrangement. Your software must print a complete copy of

your document on each pass for each copy

requested, not multiple copies of each

page. So far, this has been the rule, but, as

and Technical Reference manuals for the

printer. They detail, sometimes cryptical-

ly, every facet of Laserjet operation, from command codes through internal switch

As an adjunct to those manuals (and

upgrade it, rules are made to be broken.

ucts, among others. One warning: the collators that have ap-

Collated output solutions run from the

larger tray (much like the Laseriet 500).

Sterling Computer Products' Paper-

as 40 percent.

PC MAGAZINE # APRIL 28, 1987







FOR SOME, SHARING COMES NATURALLY. OTHERS NEED MICROFAZER VI.

MAKE THE MOST OF YOUR EXPENSIVE RESOURCES WITH MICROFAZER* VI.

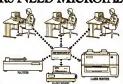
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You configure and control Microfazer VI from its front panel switches. There's no special software to run. That makes for easy "plug-and-play" operations. And it comes with 256K memory (expandable to 1 MB) to buffer even the largest jobs.



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Advanced features make Microfiaer VI the perfect alternative to many networks. We've included beginning and end of job status messages, a 20or-200 second no data time out, and the ability to automatically configure printers to specific user needs. No wonder Microfiaer is the number 1 name in periphenal controllers.

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QUADRAM

MICROFAZER VI. BECAUSE RESOURCES WERE MEANT TO BE SHARED.

CIRCLE 190 ON READER SERVICE CARD

TECHNOLOGY

Sharing Your Laser's Power

haring a printer can make a lot of se and save a lot of dollars. Expensive printers, such as today's favored laser machines, usually combine top quality with high speed-more speed, in fact, than a single person or PC is likely to need. Sharing a fast printer puts its otherwise idle time to work, giving you more Automatic printerwork for your hardware investment and cutting capital costs when one printer can do the work of two, three, or a half-dozen. use of your investment in A \$3,000 laser shared among five users hard-copy hardware costs no more than putting dot matrix printers beside each PC overhead of a true network. If you have at

The several alternatives for printer sharing range in price from almost nothing to more than the cost of a PC. The least expensive is simply a screwdriver for detaching the printer cable from one PC and plugging it into the next. One step up in the price spectrum is an A-B switch, costing from \$50 to \$150, which lets you manually toggle the connection between two computers and a printer without tangling with cables. Next comes the automatic printersharing device, or printer resource manager, which does the thinking and switching for you, keeping several PCs in ready contact with one or more printers. These cost from \$150 to \$1.500. Most expensive is

the full-blown network, which, in most glorious form, permits you to do anything with your PCs short of masic.

Given the choice, undoubtedly expensive would choose the network, probably because networking is the loudest buzzward in compating circles today. But for most smaller installations, the network is far from the best choice. The network is expensive, both in equipment expenses and in the time required to train users and the necessary network manager. In many cases, the power of the network is unnecessary. You don't need electronic nessage if you can than around and talk to your gift you have no files to sharing. If you have no files to sharing if you have no files to sharing the contraction of the property of the pro

Automatic printer-sharing devices are generally an easier way to make better use of your investment in hard-copy hardware. At best, you won't need any additional training because the systems are essentially invisible. At worst, you'll need to read a manual to get to know all the special features of the hardware, such as code-controlled switching.

Best of all, a printer-sharing system is much less expensive than a network (and much more convenient than a screwdriv-

sharing devices make better use of your investment in hard-copy hardware without the headaches and overhead of a true network. If you have at least a couple of PCs and a laser printer or other expensive, high-quality, high-speed printer, you'll want to consider buying one.

■ PRINTER-SHARING DEVICES

er). Even the most costly sharing systems that link six or more PCs are priced only a little higher than a single node of some net-

That's the fundamental difference between true networks and printer-sharing systems. When installing a network, your goal should be an increase in versatility and functionality. Your aim in adding a printer-sharing system should be to reduce equipment costs.

MIX AND MATCH The decisions involved in selecting a printer-sharing device are manifold, mostly involving accurately matching the features of various products to your interconnection needs and your equipment.

Before you consider any of these devices, you should have more than one computer and one or more moderately expensive printers. After all, spending \$500 to share a \$300 printer is rather pointless. Even when the printer and the sharing device are equally priced, getting two printers usually makes more sense because both printers will likely last longer with less severe use. But if you have a laser printer or other more expensive, high-quality, highspeed printer, you're a good candidate for a printer-sharing device.

Once you've determined that you can benefit from sharing your printer resources, you should determine the number and the type of ports that you'll need. Each computer will require an input port on the printer-sharing device. Each printer will require an output.

In addition to mere numbers, you'll have to determine the type of connection to use-serial or parallel-in each link in the system. The connection to the printer is often a foregone conclusion-the printer you have (or are planning to buy) comes equipped with the style of port that you will have to match.

The links to the various PCs require more thought. Your obvious preference would seem to be the parallel connection. After all, both PC hardware and DOS are designed to favor parallel ports for printers. Moreover, in the realm of personal computers, the parallel connection is more straightforward and trouble-free. Generally, IBM-style parallel circuits work when they are plugged in.

In fact, the only problem you face when | making the parallel connection is getting the right cable. IBM chose a different connector than had previously been used for its parallel output. With the groundswell of support for the PC standard, the IBM parallel port has become standard, and the ordinary Centronics-to-Centronics parallel cabling preferred by some printer-sharing devices may be more difficult, and more expensive, to obtain.

· Getting a serial channel to work can elicit the foulest of language from conservative mouths.

LONG DISTANCE When sharing printers, however, the parallel connection poses its own problems. Foremost among them is distance. Because of their highspeed nature, parallel interconnections have a limited reach. In most cases, manufacturers recommend that parallel cables run no longer than 10 feet. While you may encounter no problems with more-distant parallel links, you have no assurance that they will work. Cables that stretch too long can result in errors in transmission or even a failure of the circuit to work at all. (I have personally encountered such failure with a

25-foot parallel cable run.) Another shortcoming of parallel interconnections that's often forgotten is the cost of the cable itself. By their very design, parallel circuits require a greater number of cable conductors (25- and 36pin connectors) than do most serial channels (9- or 25-pin connectors). As a result. cable costs are often higher for parallel circuits. Although in short cable runs the costs of fabrication overshadow the difference in price between serial and parallel wiring, the difference can be substantial when circuits get long.

Shared resource systems naturally tend to stretch all over the countryside, and a 10-foot cable is a harsh restriction. Consequently, most resource-sharing devices rely on serial connections-to the detriment of everyone's sanity. Suffice it to say that getting a serial channel to work can perplex the best engineers and elicit the foulest of language from the most conser-

vative mouths Fortunately, the manufacturers of most printer-sharing devices will either supply cables that work in the serial ports of a PC or provide instructions for making the cables needed to work with their own devices. Moreover, most manufacturers now understand where the largest share of their market lies and have designed their printer-sharing systems to work optimally with IBM PCs. When you use the manufacturer's own cables and follow a few simple rules (see sidebar "Serial Considerations"), such a serial printer-sharing system can be as easy to install as one based on parallel links.

INTELLIGENCE TEST Printer-sharing systems differ both in their intelligence and in their mode of operation. By definition, an intelligent device possess the built-in smarts of a microprocessor. There are some microprocessors that have higher IQs than others, however.

In printer-sharing devices, this native intelligence shows up in the handling of multiple input. Most dumb units, as well as some supposedly smart ones, operate by polling ports and switching their output to the first port found that has data that needs to be printed. All other input is switched off until that first print iob is completed. So, anyone else who tries to print a document after the first job starts must wait -and wait and wait.

The smarter printer-sharing system design allows concurrent input. The printer resource manager accepts information from multiple ports simultaneously. While one job is printing, the others are stored or 'spooled" in a memory buffer without a wait. After the first job finishes, the sharing device automatically sends the next one to the printer.

Simple polled/switching systems may be sufficient for small systems with light printing loads. However, when the demand for the printer is high, they are likely to cause substantial waiting. The smarter units avoid the wait.

Many printer resource managers allow

SERIAL CONSIDERATIONS

few of the ground rules of serial con-Anections may help you cope rather than grope with getting everything to work when you're using serial connections in a printer-sharing system.

All serial ports can be classified as either DTE (data terminal equipment) or DCE (data communications equipment). terms that define which pins in the cable connector handle particular signals. The important thing to remember is that only unlike ports can be directly connected—a DTE device can be directly connected to only a DCE device. Connecting like ports (for instance, DTE to DTE) requires a "null modem" or crossover cables that rearrange the signal pinout. The serial ports on the IBM PC are configured as DTE with a 25-pin (PC, XT) or a 9-pin female connector. The inputs to printer-sharing devices may be either-or they might even be switchable.

Using a serial port to drive a printer or most printer-sharing devices also requires you to use DOS's MODE command to reassign the printer port name to a serial port and to set up the serial port conditions, which usually amounts to two additional lines in your system's AUTOEXEC.BAT file.

Some software, however, may attempt to drive your computer's printer

port directly and may not recognize the reassignment. The easiest way around this problem is a parallel-to-serial converter, which makes the parallel output of your computer into a serial signal.

Serial circuits also have other characteristics that you must consider, such as bit rate, word length, parity, and handshaking. Most printer-sharing devices offer their own recommendations for which values to use, for example, 9,600 bps with standard PC serial ports, eight data bits, one stop bit, and no parity. Use the fastest available bit-per-second rate your device supports.

Some serial-oriented printer-sharing devices allow you to configure each port differently. Others force you to use the same parameters for each port. When you have control over all the PCs sharing a printer, even the latter style of port management should be sufficient.

Nearly all devices automatically handle protocol conversion, allowing the attached computers to operate at different data speeds than the printers-or even converting serial computer signals into parallel printer signals. You may or may not need these features, depending on the printers and computers that you want to connect and how you want to connect them.-Winn L. Rosch

the connection of more than one printer to 1 the system and use some form of software

steering to select which of them is used for a particular print job. Usually the switching commands take the form of control characters embedded in the data stream, sent to the printer-sharing device either inside the file to be printed or as an entirely separate command. These control codes are captured and relayed along to the printer for hard-copy output. Some devices may instead allow the manual selection of which print jobs go where, usually by

pressing front panel buttons on the device

itself. Depending on your mechanical and

programming talents and your ability to re-

member sometimes areane control se-

quences, either style of control may be best

Other generalizations about printersharing systems are difficult to make. Each manufacturer has its own concept of the proper configuration and function of the devices. The best way to find the system that's right for you is to look at what's available and match the features of the different products to your own needs. To help you make your decision, here's a look at nine intelligent printer sharing-devices from Black Box Corp., Buffalo Products, Crosspoint Systems, Digital Products, Extended Systems, Fifth Generation Systems, Rose Electronics, Server Technol-

review manual switches. While there are differences in construction, quality, and reliability, the prices and the units are more alike than not and most units should work adequately. Reviews are arranged in alphabetical order by company name.

Black Box Corp.

Auto Six Shooter Black Box Corp. specializes in solving

communications problems, and the Auto Six Shooter is only one of the company's solutions to sharing one printer among several PCs. As an automatic printer-sharing device, it is simple in both conception and operation. It accepts input from up to six PCs and connects them to a single printer, using a simple arbitration scheme to divide up the printing resource.

The Auto Six Shooter works like a police-band radio scanner, sequentially investigating each input for a computer that wants to use the printer. At first, all of the PCs connected to the unit are given a hardware signal that tells them that the printer is busy. One at a time, in sequence, the unit turns off the busy signal and then waits for the connected computer to attempt to send something to the supposedly just-freed printer.

If the PC tries within a short period, the Auto Six Shooter latches onto that PC's input port and connects it directly to printer output. It maintains the connection until a pause in the data stream stretches out for another predefined period. After the delay, the Auto Six Shooter assumes the print job is done and starts scanning the input ports



Auto Six Shooter Black Box Corp. Mayview Rd, at Park Dr. P.O.Box 12800 Pittsburgh, PA 15241 (412) 746-5530 List Price: \$465

Requires: Parallel port In Short: A scanning, six-input, one-output printer-sharing system using Centronics-style perallel connections CLE 649 ON READER



Up to six PCs can be connected to a single printer with the Auto Six Shooter. The device sequentially investigates each input for a computer that wants to use the printer.

again for a PC wanting to print.

again for a Pc. Wanting to print.

To match different system arrangements, four settings are allowed for each of the two delay periods, selectable by an internal DIP switch. The first period, during which the Auto Six Shooter waits while scanning for a PC to try to access the printer, can be set a either 320, 640, 1,280, or 2,560 milliseconds, or 4½ to 2½ seconds.

The delay identifying the end of a print job can be set to 1.2, 7, 17, or 28 seconds.

A jumper allows setting the Auto Six. Shooter in one of two modes of operation: priority or nonpriority. In priority mode, the lowest-numbered of the six. PC input ports are deemed the most important and are the first to be tested for printer demand upon the completion of each print job. In this mode, the unit always starts is scan at port one and works its way up to port six. In nonpriority mode, the Auto Six.

Shooter always scans sequentially. After servicing a print request on port four, for instance, it will next poll port five.

All input and output connections are parallel, made using female 36-pin Centronies-style connectors. For the PC market, the Auto Six Shooter might possibly be improved by substituting a female DB-25 connector for the printer output so that the same standard IBM printer cable can be used for all of the connections.

The whole system is quite compact, under 1½ inches high, 12 inches long, and 8 inches wide. The entire system is simply but effectively packaged and well made. As you would expect from its maker's name, the Auto Six Shooter is black. Inside, the circuitry is spare, only 21 integrated circuits total.

The instructions are terse, covering the equivalent of two typewritten pages. They are, however, sufficient to put the Auto Six Shooter into operation.

The Auto Six Shooter requires a minimum of operating power, which it can derive in one of two ways. A small black transformer is provided for direct connection to a wall outlet, or the unit can sip electricity through one of the PC input ports. The power source is determined by moving a jumper to a position behind the power supply port or to the power supply section of the system board.

The Auto Six Shooter requires only 200 milliamps of 5-volt direct current (1 watt) not an arduous load for a PC to supply. Of course, it loses power when the PC that's plugged into the wall outlet is shut down, so you'll have to think about which system you want to keep it alive.

design goal, but in busy systems you might lose both your palenon and your patience. When one computer is using the attached printer, all others must wait. With singleminded software, that prospect can effectively tum your PC into a vegetable while you wait. Should someone ahead of you decide to print out a 500-page manual, you might as well go to lunch.

In light-duty applications, though, in which multiple, simultaneous requests to use the printer are minimal, the Auto Six Shooter may be the only arbiter you need.

Buffalo Products

Buffalo XL-256

Although the most modest device examined here, with two computer input ports and two printer output ports, the Buffalo XL-256, from Buffalo Products, may be the most useful to the individual PC user. The XL-256 is a manually operated printer switch enhanced with a bit of automation and a 256K-byte buffer. (Other models are available with internal buffers of 64K, 512K, and I megabyte.) In operation, the XL-256 allows either

of the two PCs connected to it to use either of the two printers, assigning each computer to each printer under manual control. Not only can signals be routed straight through (for example, computer A to printer A and computer B to printer B), but they can also be routed in crossed-over configuration (computer A to printer B, and so on) or with both computers sharing a single printer.



Boffalo XL-256
Boffalo Products
2005 Devereux DBorfangaren, CA 94010
Borfangaren, CA 94010
List Price; Sa55
Requires: Parallel port
In Short: A combination 2568, dyste point
spooler and manufaly activated porallel port
swith. It allows two computers to share one
of the products with concurrent experience.

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Using hardware switch boxes to share printers is now obsolete. Introducing EasyPRINT," the advanced lowcost solution to the problem of how to share laser, dot matrix, letter quality printers, and

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- ellite PCs. The spool size on the HUB PC is limited only by the size of the disk. Advanced Forms Support. It solves the paper changing problem without adding expen-

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gram provides a menu driven installation program that will guide you step-by-step through the software installation process and lets you redefine your network as your printing requirements change.



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Item	Description	Price	Qty	Amount
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SHARING THE WEALTH: USING YOUR NETWORK TO GET THE MOST USE FROM YOUR LASER PRINTER

Zero-slot or RS-232C LANs, such as Zero-slot, from Server Technology, or LANLink, from The Software Link, allow several PCs to exchange files and share printers by using only their RS-232C ports.

Zero-slot LANs are a little harder to set up than are digital switch devices, but after the initial setup they are as easy to use and usually offer the same features. Some systems can share a printer between as many as six PCs, but using two or three PCs is more practical.

Although zero-slot LANs run about S100 per port (about half the price per port of a digital switch) and allow you to transfer files from PC to PC in addition to sharing a printer, they put an added workload on the processor of every PC in the network. In addition, the regular computing activities of the machine acting as the print server in an RS-232C LAN can be slowed significantly.

The most expensive alternative for printer sharing is a media-sharing LAN using separate network adapter cards such as 3Com Corp.'s EtherLink. AT&T's StarLAN, or Proteon's ProNET-10. This type of system usually offers a major increase in network speed over the RS-232 CLAN or a digital switch, but it has few other operational advantages for printer sharing, in sophisticated systems, the network administrator can assign a specific priority of work to every user, and users can ask to receive messages telling them that a printing job

is done.

10-NET, from Fox Research (see "Making Connections: Fox Research No-NET," PC Magazine, Volume 6 Number 3), has an excellent print job spooling system bull into its networking software. 10-NET's retail price of about 5000 per workstation is several hundred dollars less than most other media-shareness. The state of the s

A media-sharing network is hard to justify in terms of cost if you need only to share a printer between several PCs. If you use other LAN features such as a networked database management system, printer sharing is essentially free.

People using a media-sharing network to share printers usually rely on DOS batch jobs created by the network administrator to route the output of an applications program through the network to the print server. A user might type the word LAZER at the DOS level to designate that the printed output of all programs that follow should go to the shared laser printer. The network administrator would put the appropriate commands in LAZER BAT to link the user's workstation with the shared printer. Other batch files named DOT, PLOTTER, or COL-OR could be created to send output to other appropriate devices. The most popular networking software packages include menus allowing users to choose from the available networked output devices, but batch files are more commonly prepared to do the job.

-Frank J. Derfler, Jr.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

In the last configuration, the XL-256 functions as an intelligent printer-sharing device. Both input ports are held ready. The first computer to send data to the XL-256 gets direct access to the printer. If the other computer then also begins to send data, the information from it is buffered inside the XL-256.

The XL-256 determines the end of a print job—when to make the switch—by a pause in the data stream. You can define the length of pause necessary to trigger a changeover at either 0.5, 1, 4, 15, or 60 seconds by an internal DIP switch. (The default is 4 seconds,) If multiple jobs that are all bound for the same printer stack up in the buffer, they are handled on a first-in, first-out basis:

The most modest

device examined here may be the most useful

to the individual user.

Despite the nominal 256K-byte rating of the buffer inside the XL-256, its effective capacity may be somewhat larger in that the device uses an unspecified form of data compression. You'll have to take the manufacturer's word for its effectiveness,

however, because the amount of squeeze is not readily determined, and 256K bytes (equal to 125 double-spaced pages) should be sufficient for all but the most bombastic

essayists.

The plastic front panel of the attractive beige metal 6½- by 3- by 9-inch case is divided into two identical control sections, one for each computer. Each control area is equipped with two push buttons. The large, square one labeled "Select" permits the print job from the associated computer to switch from one printer to the other. The XL-256 has no provision for code-controlled switching.

If you press the Select push button associated with a computer while no job is being processed, the switch is made. If, how-

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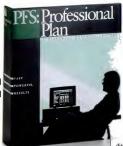
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■ PRINTER-SHARING DEVICES



Either of two PCs connected to the Buffolo XL-256 con use either of two printers Signals can be routed straight through, in a crossedover configuration, or with both computers sharing one printer. The device's obility to eliminote cobleswopping and speed up throughput with print buffering makes it on ideal occessory for the individual user or for very small systems.

ever, you press it while a job is being processed, the printer is assigned to "exclusive" mode, and it becomes unavailable to the other computer until you again press the button

Three indicators aid in the use of this button. Two green LEDs indicate which printer is assigned to the computer. A third, yellow LED glows when a job is in progress.

A smaller, rectangular push button, the belded "Clear," halts the current print job and flushes the buffer of the XL. The Clear buttons for each of the two computers function independently, and flushing the buffer associated with one computer will not affect that of the other. A power-switch and a power-on indicator complete the front-panel controls.

The rear panel of the XL-256 has four female Centronics-style 36-pin connectors, one for each input and output port. A jack is also conveniently provided for a

power cable. The XL-256 power supply is internal and operates directly from 117volt line current.

Despite the modest systems that the XL-256 supports, its setup can be quite complicated. Inside the case are eight DIP switches (five are accessible through a cutout in the bottom of the case), which allow you to set hardware defaults and match different types of parallel interface (just when you thought a parallel port was a parallel port and required no setup!). The instructions, although in most places quite readable don't give much help. You'll probably have to be clairvoyant to figure out what the manufacturer intended. However, the defaults are set so that the XL-256 works right from the box. For very small systems-two PCs and

two printers—the Buffalo XL-256 can be a useful accessory to eliminate cable swapping and speed up throughput with print buffering

Crosspoint Systems Inc.

Crosspoint 8

As its name (and the name of its manufacturer) implies, the Crosspoint 8 can be described technically as a crosspoint switch. You can connect any of its ports individually to any of its other ports, as with the connections made on a telephone switchboard (the classic case of a crosspoint switch). No operator is required, however, because the Crosspoint 8 is entirely electronically controlled. Several connections can be made similar acoustly.

All the eight switchable ports provided by the Crosspoint 8 are serial and function bidirectionally as input, output, or both. All use six-pin telephone-style modular jacks.

Crosspoint Systems manufactures a number of adapters to convert standard DB-25 (and AT-style DB-9) connectors to modular and supplies eight of the adapters (the most useful two of the four available 25-pin styles) with the Crosspoint 8. Bight modular-to-modular cables are also supplied two that are 20 feet long and six that are 6 feet long. You get a complete kit of verything you need to set up a full system.

A software program supplied with the Crosspoint 8 controls the various interconnections between the ports, from computers that can be attached to any of the ports.





The real intelligence of the Crosspoint 8's system lies in the

'host'' PC ottached to it. The host receives information from the Crosspoint 8 through a parallel port ond controls the device through o special driverlike program in the background. If this program is not running or the host is unavailable, the unit maintoins existing connections even if. for instance, the host crashes.

are made using software. Crosspoint Systems supplies a paper worksheet to help organize the complex configuration job. Each PC attached to the Crosspoint 8 and able to switch it requires a copy of the setup information and control software.

In addition to sharing printers-seven PCs can share one serial printer, six can share two, five can share three, and so on-PCs linked to the Crosspoint 8 can share files if your communications software permits such transfers. The Crosspoint 8 can also link non-PC serial devices to one another without a PC being involved, for instance, connecting a modern directly to a printer.

The Crosspoint 8 is unassuming physically, just a flat rectangular aluminum tube about the size of a modern, 11/4 by 51/2 by 7 inches, painted black. The eight modular iacks fill one end. The other end has a female DB-25 connector for the parallel printer, a ribbon cable terminating in a male DB-25 connector to attach to the host's parallel port (either LPT1 or LPT2), a jack to plug in the small external transformer, and three LEDs to monitor its operation

Various levels of authorization for control are provided. For instance, some PCs may be allowed to break into any connection; others can only switch ports that are not currently in use. Up to 16 different userdefined interconnection schemes are supported.

You can choose to run the control program in one of three ways: menu-driven and loaded directly from the DOS prompt. menu-driven as a memory-resident program activated by "hot keys" (Ctrl-Shift) like SideKick, or in a command-driven batch mode. Batch mode permits you to construct batch files that automatically configure the Crosspoint 8 to match each application that you run.

The real intelligence of the system is not in the Crosspoint 8 but rather in a PC attached to it and designated as the "host," The host receives information from and controls the Crosspoint 8 through a narallel port.

A jack is provided on the Crosspoint 8 to daisy-chain a parallel printer so the host does not sacrifice the normal use of this parallel port to the Crosspoint 8. This parallel printer is not controlled by the Crosspoint 8 and cannot be connected to any of its serial ports. For the host to have access to the switchable ports in addition to controlling them, it must also be linked serially to the Crosspoint 8.

To control the Crosspoint 8, the host computer runs a special driverlike program in the background. If this program is not running or the host is otherwise unavailable, the unit will not switch but will maintain existing connections, for instance, if the host crashes during use.

The Crosspoint 8 also operates as a form of protocol converter. All the operating parameters of each port can be individually defined (except for its definition as DTE or DCE, which is controlled by the modular plug adapter). All configurations

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PrintDirector MS-1 Based on a Z80A microprocessor, the

PrintDirector MS-1, from Digital Products, combines the features of a protocol converter, a printer-sharing device, and a print buffer. By itself, it provides seven



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■ PRINTER-SHARING DEVICES



The design of the PrintDirector MS-1 allows several ports to be simultaneously connected to each other. The device can be programmed to give any PC access to the first available printer.

ports—four serial and three parallel—that can exchange data in almost any arrangement. The MS-1 parallel ports are bidirectional (they function as input and output) and can be connected either to PCs or to printers. Two or three PrintDirector MS-1s can be cascaded to provide up to 17 ports, all under intelligent control.

The MS-I acts as a protocol converter in that all of the communications parameters of its serial ports are programmable. Although two serial ports can be spring-series desired, series and series and series and series and series as the serie

As a print buffer, the MS-I provides MC, 250K, or 500K byes of memory (depending on model) for data spooling. The buffer is dynamically allocated between port can use almost the entire 500K byes of RAM, at least It is always reserved to each individual port so that in no case—except the entire buffer filling up—will any computer output suffer a delay in waiting to use a printer.

The design of the MS-1 allows any port to be connected to any other port or group of other ports. Several such connections can be made simultaneously. In addition, the MS-1 can be programmed to give any PC access to the first available printer or any particular printer. PCs can also communicate to moderns or other PCs through the serial connections.

All of the switching is controlled through software by injecting command codes—character sequences preceded by a user-definable attention character, normally a tilde—into the data stream. This software control rates as the most versatile and feature-laden of the devices examined here.

All ports are identified by one or more names, which you define to suit your needs when you set up the system. When references are made to a port, you only use as many characters of the name as are needed to unambiguously identify it. Ambiguous references are handled like wildcards: all ports sharing the ambiguity are connected.

For instance, if you have two ports called Epson and IBM, a single character would be sufficient to identify which one you wanted to use. However, if you called the ports Epson Printer and IBM Printer,

making a reference to Printer (or an abbreviation thereof) would automatically access both.

As with most printer-sharing devices, the MS-1 determines the end of a print job by a pause in the data stream. You can program any period from 1 second to 255 seconds or infinity.

The MS-1 also offers facilities to send lead-in sequences (for instance, printer initialization codes) and end-of-job codes automatically to the appropriate devices, all keyed to the port assignment. As would be expected from a device as versatile as the MS-1, orogramming it can

be complex. The job is not facilitated by the instruction manual, however, which seems organized more by stream of consciousness than by logic. Digital Products includes an auto-install program to simplify matters and allow you to make all the setup adjustments from your PC. Alternatively, you can assign ports and change communication settings using the eight front-panel switches and LEDs of the MS-1 (a task actually much easier than wading through the instructions would lead you to believe). Configuration information is stored in CMOS memory that is kept alive when the MS-1 is turned off by an internal rechargeable nickel cadmium battery with sufficient reserves to keep that data (but not the information in the buffer) intact for

Physically, the MS-1 is cleverly designed and well made. The entire system, including the self-contained power supply, fits into a blue metal box that's about 3½ by 12 by 11 inches, not counting its ¼inch rubber feet. On the whole, it's little more than one big, cleanly laid-out printed circuit board.

a month or so

The serial ports all use female DB-25 connectors, and the parallel ports are equipped with female Centronics-style 36-pin connectors. Only the eight blue front-panel push buttons are disconcerting; press one, and the whole bank dips rather ominously.

Af nearly \$1,400, the MS-1 is the most expensive device of this group, and its cost alone might give you second thoughts. It is, however, also the most versatile printer-sharing device and still offers considerable savings over dedicating one printer to every computer.



SHARE PRINTERS AND BUFFER PRINT JOBS WITH ONE VERSATILE UNIT

Print Master from BayTech is an intelligent printer controller that connects between your computers and printers. It allows you to share one printer automatically, contend for

multiple printers automatically, or switch between several printers by sending a simple code, not by changing cables. Plus, Print Master's generous built-in buffer spools data until your printers can receive it.

Because Print Master is a very flexible device, you can set it up to fit your application, even if your application changes.

YOU SET UP THE IN-OUT PORTS

You configure Print Master's ports for any combination of printers and computers by answering questions from easy-tofollow menus. For example, with the ten port Print Master, nine computers can share one printer, eight computers can share two printers, seven computers can share three printers, and so on, to one computer which can share nine printers. You can also menu-select the disconnect time-out, form feeds, etc. and on serial models the configuration of individual ports to translate for printers and computers using different configurations.



512K OR ONE MEGABYTE BUFFER KEEPS YOU WORKING INSTEAD OF WAITING

Since Print Master can accept data faster than your printer (up to 19.2KB serial or 5,000 characters per second parallel), you can send a print job to Print Master's standard 512K

Print Master's standard 512K buffer and then go on to another project. All users connected to Print Master can send data to this common pool buffer, and they can be doing it simultaneously, even if no printer is available. Data is

stored in the buffer

until it can

be sent on a first-job-in first-jobout basis to the selected printer. If you need more memory than 512K, Print Master is optionally available with one megabyte buffer.

If several users are sharing one printer, printer sharing via Print Master is completely automatic. There are no codes to send. You simply perform your normal print operation. If you are sharing several identical printers, connection

is also

automatic. Again, you perform your normal print operation and are connected to the next available printer on a first-cor first-serve basis. Print Master will send data to all printers simultaneously to keep your printers running at full capacity. If you are sharing several different printers, such as a laser-jet, a dot matrix and a plotter, and you wish to select a specific printer, you do your normal print routine and also send a printer select code (which you can define yourself) before the first characters of your data The data is then routed to the selected printer. It's that easy.

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All above models have standa 512K buffers. Additional 500K buffer, \$249 RS422A for distances up to 4,000 feet now available on

some models

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Extended Systems Inc.

ShareSpool ESI-2076

Based on a 280 microprocessor, Extended Systems' ShareSpool ESI-2076 is an intelligent printer-sharing system that incorporates a 256K-byte buffer that's expandable to 512K. It accommodates up to seven computers, mediating their demands to a

single printer.

All devices attached to the ShureSpool use serial signals. The seven input ports from computers are equipped with modular connectors; the output to the printer uses a female DB-25 jack. (Another similar printer-sharing system that uses parallel signals is available from Exended Systems as the ShureSpool ESI-2078, Exended Systems supplied sufficient adapter than the supplied of the supplied sufficient adapter full system. The company will also supply cables separately and includes instructions in the manual for making your own.

All computer connections are simultaneously active and can receive data concurrently. All data bound for the printer is spooled separately in the RAM of the ShareSpool until the completion of the print job, marked by a pause in the flow of data of more than 10 seconds (or other user-definable period). Multiple print jobs are queued in a first-in, first-out sequence.

The memory of the ShareSpool is partitioned dynamically, so each print job uses only as much as it needs. The whole of the unused memory is available to each job.

The operating parameters of each serial port are set by using three banks of eight



The microprocessor in the ShareSpool ESI-2076 recognizes a limited repertory of commands embedded in the characters sent to it for printing These commands let vou designate an endof-iob reset string. print multiple copies of a single job without tying up the originating computer. assign high priority to multiple printing jobs. and switch off the detection of commands until the current iob is done.

DIP switches behind the front panel of the ShareSpool. All ports support speeds between 300 and 9,600 bits per second. The manual recommends setting all ports to a word length of eight, no parity, and one stop bit, although other settings are also

available.

Both hardware and XON/XOFF handshaking are supported. In the computer-toShareSpool connections, handshaking appears to be necessary only when the entite
buffer is full; otherwise the serial connections are always active and operate at full

speed.

The microprocessor in the ShareSpool also recognizes a limited repertory of commands that are embedded in the characters sent to it for printing. The system uses an unchangeable attention string of period-comma-colon (...), which is unlikely to

occur in normal text.

One command changes the timeout period representing the end of a print job

from its factory default of 10 seconds to any period up to 255 seconds. A second command allows you to designate an endof-job reset string, which is sent to the printer at the conclusion of each print job.

The default is a form-feed.

Two commands allow you to print multiple copies of a single job (up to 255) with out tying up the originating computer. One assigns high priority to the multiple printing job, so that finishing all copies takes precedence over other multiple-copy jobs. Low priority allows other jobs to interrupt after each copy has printed. All individual print jobs and the first corey of a multiple-copy in the printing that is not provided in the printing that is not printing that it i

copy run are treated as high priority.

The final command switches off the detection of all commands until the conclusion of the current print job. This is useful in graphics printing and "cascading" ShareSpools (connecting the output of one to the input of another).

One hardware control is provided, a

FACT FILE

ShareSpool ESI-2076 Extended Systems P.O. Box 4937 6062 Morris Hill Ln. Boise, ID 83711 (208) 322-7163

List Price: \$995 with 256K RAM buffer; additional \$100 for \$12K RAM buffer. Requires: Serial port.

In Short: A serial-only device that allows up to seven PCs to share a single printer with concurrent printing and a 256K-byte print

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CIRCLE 251 ON READER SERVICE CARD

THE INTERFACE SPECIALISTS

■ PRINTER-SHARING DEVICES



Printer-Sharing Devices: Summary of Features (In ascending price order)

INPUT OUTPUT List price size Type \$74.95 (manu and disk) \$159.95 (two-PC kit no Six Shooter \$485.00 6 parallel Centronics None 1 parallel Centronics ack Box Corp. Buffalo XL-256 \$485.00 2 parallel Centronics Concurrent 258K 2 parallel Centronics **Buffalo Products** Logical Con Fifth General \$495.00 (256K RAM DR. 255 258K Bidirectional DR-26ET Systems \$595.00 (512K RAM 2 parallel DB-25M 2 parallel DB-25F1 huffer) Crosspoint 8 \$500 m Modular Concurrent DB-25ET 8 senal None Bidirectional Crosspoint Syst 1 parallel DB-25F1 Carataker Plus \$695.00 8 parallel Centronics Concurrent 256K 1 parallel P-8P/256 lose Electronics tern Tele DR-259 Scanned 256K \$895.00 1 senal **DB-25M** PSU-81B 1 parallei Centronics Western Te ereSpool ESI-2076 \$995,00 (256K RAM Concurrent 266K 1 serial DB-25F Extended Systems buffer) \$1.095.00 (512K RAM PrintDirector MS-1 \$1,395,00 DB-25ET 4 serial DR-25F 258K Digital Products Inc Centronics D38F1 3 paralle

—indicates Editor's Choice. — Yes — No N/A—Not applicable: EasyPhint is a software-only product that can handle up to 15 computers and/or 5 printers, up to a total of 16 devices.
*Input port/connector can also function as output port/connector.

single push button on the front panel of the ShareSpool that aborts the current print job (but leaving those following unscathed). When you press the button, the printer is sent a message "*** Job Aborted by User *** and a form-feed.

When nothing is printing and the Share-Spool is idle, this same switch elicits a diagnostic self-test. The test results are displayed very simply: if the ShareSpool passes, a nearby LED glows green; if it fails, the same LED glows red.

tans, the Sante ELD grows seed.

The SharesSpool is packaged in a naturally finished rectangular extuded alumination of the soft of the so

Fifth Generation Systems

Logical Connection Fifth Generation Systems' Logical Con-

nection supplies an unusual and, seemingly, almost illogical array of connectors: four serial ports, two parallel input ports, and two parallel output ports. Otherwise, no push buttons, controls, blinking lights, or navigational beacons are visible on the long, flat, 1-by 14-by 5-inch box. A white

power supply brick plugs into one end.
The logic of the system is brought to life
by the 280 microprocessor inside. The 8tit CPU allows the ports of the Logical
Connection to be patched together in almost any arrangement, making protocol
conversions along the way. Multiple Logical Connections—up to 45 units spanning
up to 4,000 feet of twisted-pair cable—can
be daisy-chained and run cooperatively.

Feferively yeldning approximately 315 lo-

cations to plug in peripherals.

The intelligent design of the Logical Connection (intelligent because of its microprocessor base; we'll let you judge the abilities of its engineering) permits you to connect it to both your PCs and your printers by either serial or parallel ports, and the PCPU makes sense out of everything. It even translates serial port data rates, word lengths, and partities and handles both XON/XOFF and hardware handshaking it-

self. The system is entirely programmable, so you can switch the connection between any two ports on the Ju merely by sending an eight-character control string (which you define youngle) lool the Logical Connection know what to do. The Z80 microprocessor is fast cought to handle profits an normal communication rates without performance degradation. When simultaneous requests are made to print to a port, the standard 250K-byte or optional

OUTPUT SWITCHING

Automatic	control	Manual
•	0	0
0	0	0
0	0	•
•	•	0
0	•	0
•	0	0
•	•	0

EasyPrint can control this number of inputs/outputs on its host



FACT FILE

Logical Connection Fifth Generation Systems 909 Electric Ave., #308 Seal Beach, CA 90740 (800) 225-2775

(213) 493-4483 List Price: \$495 for 256K; \$595 for 512K. equires: Serial or parallel port. In Short: A resource-sharing device that permits the sharing of printers and other peri pherals using four serial ports, two parallel

input ports, and two parallel output ports. It supports protocol conversion, concurrent printing, and 256K bytes of spooling.
CIPCLE 663 ON PEACER SERVICE CARD 512K-byte memory is used for buffering,

absorbing printer-bound data until the device becomes available. The entire setup procedure is handled

by menu-driven firmware contained inside

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CIRCLE 287 ON READER SERVICE CARD



The 8-bit CPU allows the Logical Connection's ports to be attached in almost any arrangement. Multiple Logical Connections can be daisy-chained to yield 315 places to plug in peripherals.

the Logical Connection Itself. This progord of the Control of the Progord of the Control of the Control of the Control of the Control of the Logical Control of the program to set things up. The unit automatically deciphers the bit rate and other parameters of the Serial signal, so you don't even have to worm you the initial configuration.

connected to each port. In the case of serial ports, the basic communications parameters are set first. Timeout periods for closing print files and character strings to switch ports are also fixed at this time. All configuration memory is retained by a small lithium battery that Frith Generation Systems claims (with wild optimism) will last up to 10 years. Two and a half years is more like it.

In a typical configuration, the Logical Connection can be connected as if it were a standard parallel printer to two PCs (through the parallel input ports), to two parallel printers (through the parallel content put ports), and to any other combination of printers and computers through the four serial ports. If more than one Logical Control parallel ports. If more than one Logical Control parallel ports.

nection is daisy-chained, the first serial port is given over to that link.

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Rose Electronics

Caretaker Plus CTP-8P/256

Rose Electronics, maker of the Caretaker Plas CTP-8P2-56, maurifactures a full line of printer-sharing devices (as well as ordinary port switches and exotic networking components) with either four or eight ports, serial or parallel interfaces, with or without internal buffers from 16K to ¼ megabyte. The Caretaker Plas tops the list, coupped with eight parallel input ports, a



Caretaker Plus CTP-8P/256 Rose Electronics P.O. Box 742571 Houston, TX 77274 (713) 933-7673 List Price: 8695 Requires: Parallel ports.

In Short: An intelligent device for sharing one parallel printer among eight PCs with an internal spooler permanently partitioned to give a 32K-byte buffer to most of its inputs. ORGE SAT ON WEARS STRUCE CARD.

single parallel output port, and 256K bytes of memory for print spooling.

The Caretaker Plus is an intelligent printer-sharing device that's based on an Advanced Micro Devices P8031 chip. It can simultaneously receive data on all eight input ports, buffer the data, and route each print job on a first-in, first-out basis to the printer.

The Caretaker Plus's internal buffer is permanently, and somewhat arbitrarily, partitioned among the input ports, however, with six each receiving one-eighth of the total RAM and two sharing another eighth. (The device apparently uses the remaining one-eighth for system operation and overhead.)

The Carctaker Plus determines the end of a print job by the lapse in the data stream from the associated input. The default setting for the timeout period is set at 10 seconds, but you can change it to any full-second interval between 1 and 99 seconds when the device is configured.

The rather plain rectangular case of the Caretaker Plas, which measures 4 by 10½ by 5½ inches, is attractively finished in two-tone beige. Inside, the device is elegantly engineered, using one small circuit board for its power supply and main processor with separate daughtercards for each input, the output, and buffer memory componentry.

The rear panel of the case is filled with nothing but jacks—eight female Centronics-style 36-pin connectors and a DIN-jack for attaching an external wall-mounted transformer. You can thus easily connect PCs to the Cacataker Plus using normal printer cables. The manufacturer also sup-



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■ PRINTER-SHARING DEVICES



The top-of-the-line Caretaker Plus CTP-8P/256 simultaneously receives data on all eight inputs, buffers the data, and routes each print job on a first-inifirst-out basis to the printer.

structions.

plies a Centronics-to-Centronics cable with the unit for the connection between it and the printer.

The front panel of the Caretaker Plus has two controls and 13 indicators. The controls comprise two push buttons labeled "Advance" and "Select", which together change the operating mode of the unit. Pressing both buttons when the device is already turned on forces it into configuration mode, and pressing them again returns it to normal operation. Holding the buttons on when it is turned on enters it into a diagnostic mode, which is canceled only by swikeling to of Bazin.

A green LED serves as a pilot light. Eight red LEDs indicate whether each of the input ports is inactive (unlit), waiting to print (illuminated), or currently printing (flashing).

Four additional red LEDs monitor the operating status of the Caretaker Plus: Mode indicates whether it is in diagnostic mode or set for normal operation, Data illuminates when data is being received across the currently connected port, Busy lights indicate that the primer is busy; and Error signifies that an error has occurred. The port status LEDs then indicate the type of error.

You set up the Caretaker Plus by enter-

ing configuration mode, then sending the appropriate instructions to it through its number-one input port. You can use either LPRINT commands in BASIC or a terminal emulator to send the simple setup in-

In most normal installations, parallel models of the Caretaker Plus will require no configuration; however, some parallel port parameters and the timeout required for port switching can be modified. With serial models, the various port parameters (bit rate, parity, and so on) are set by using configuration mode.

The Caretaker Plus offers a very effective means of sharing a printer between PCs. Its only apparent shortcoming, the inflexible buffer partitioning, is a drawback only in installations where long print jobs and user impatience are commonplace.

Server Technology EasyPrint

As a printer-sharing device, Server Technology's EasyPrint is unusual because it is a software-only product. Connected through standard RS-232 serial ports, it works as a reduced-functionality network that allows resource sharing but not direct node-to-node communication.

Viewed as a network, Eugh-rim uses "start" architecture on PC functions as a server, or hib, to which one or more workstations, called satellities, may be connected. Each satellite has access to up to five printers that are physically connected to the serial and parallel ports of the hub but are logically addressed by each serve standard DOS names, for instance, LPT1. The EmpPrim software allows the printer to have different DOS designations on each satellite and the hub.

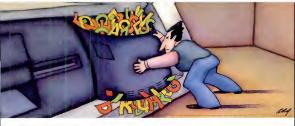
EasyPrin runs the serial ports it uses to connect the hub to the satellites as 9,600 bits per second and maintains control with hardware handshaking. Interconnecting cables, which are available from Server Technology and computer supplies dealres, use a "unil modem," or a crossover configuration of the six-conductor shielddel wisted-pair cable that is recommended.

EasyPrint works by using six short memory-resident programs, which require a total of 20K bytes of RAM on each satellite, to capture all information directed toward the various printers and reroute it to the serial connection leading to the hub. Background programs nunning on the hub, which require 20K bytes for the first statellite and 12K more for each additional satellite, route all printer information received directly to disk.

In this way, all print jobs are spooled to disk until their transmission is completed and a user-designated delay has elapsed. Multiple-print jobs can be simultaneously



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Here's how it works. When Cubit compresses a file, it first compares each word to its massive English word dictionary. Words that match are reduced to a predetermined code of just one, two or three bytes each. It then saves the abbreviated version to disk. Decompression works just the opposite. To accommodate other words and symbols,

Cubit uses two more compression techniques. One assigns new, shorter codes to unusual words. Another compresses according to the frequency of character strings in non-text data. So no matter what kind of files you create. Cubit ensures maximum space savings.

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■ PRINTER-SHARING DEVICES

■ For small systems—a hub and two satellites— EasyPrint appears to be the best bargain.

captured and queued to print on a first-in, first-out basis. In addition, EasyPrint allows different forms to be defined, in which case the spooled print jobs are kept on disk until the designated paper form is loaded into the appropriate printer.

Each satellite connected to the Easy-Faint system requires a serial port on the host. Server Technology also supplies add-on ports in blocks of two or six that allow you to extend the serial port capacity of the host up to a total of 14. Ports beyond the two accessible by DOS (that is, COMI and COMZ) are addressable only by Easy-Print

EasyPrint will work even with systems equipped solely with floppy disk drives, but because of the extensive spooling done on the hub, however, a hard disk there is almost mandatory. Hard disks are also welcome on the satellites because of the step of the satellites because of the satellites are satellites and the satellites are satellites as the sate

huge amount of code contained in the EasyPrint system.

Although both the documentation and the design of the installation programs fall far short of perfection, you can set up the system relatively quickly, and it works amazingly well. Contention for the disk resources is handled quite well, and with a light printing load, no degradation of the performance of the host was noticeable.

Testing showed that the system was not entirely trouble-free, however. The hub crashed when Peter Norton's Disk Test program executed on it at the same time a print job was sent to it. No indication of the failure—other than a printer timout message from DOS—appeared on the statellite. A well-behaved program that issues standard DOS and BIOS calls proved to be no mobilem. Nowever.

An EasyPrint system requires that you buy a copy of the program, which costs 579, for each computer on which it runs (one for the hub and each satellite). A basic kit containing everything necessary for a two-station system (two copies of the program and a 25-foot interconnecting cable) is priced at 5159.

Truly large systems with much printer activity will probably require dedicating a computer to the hub function because of the memory and disk access demands nade on it. However, for small systems (a

hub and one or two satellites) EasyPrint appears to be the best bargain in printer

Western Telematic Inc. Western Telematic

PSU-81B

The Western Telematic PSU-81B ordinarily would be classified as an intelligent printer-sharing device, but its abilities and capabilities fall short of more-recent products. Although microprocessor-based, managed by a M68B09 chip operating at 3.68 MHz, and equipped with a 512K-byte internal buffer, the PSU-81B functions as a mere scanner.

In normal operation, all eight of the serial inputs of the SIS-18 Ha me effectively switched off. Elither hardware handshize high both of the SIS-18 Hand the series is transmitted to the port. One by one, in sequence, each of the serial input pots is scanned, depending on how the FSU-81 is sea up it, ricoses the hardware handshaking to the chosen port or transmits an XON flow control character to it. If the chosen port does not respond by sending data within a short period (150 millinecomds), switch as short period (150 millinecomds), and XOFF character, then switches to kend an XOFF character, then switches to the next DOI.

If a polled port does indeed start transnitting data, the PSU-8 IB lathes onto it and absorbs the information as fast as it can be start at a selectable data rate of 300, 1,200, 2,400, or 9,600 bits per second. This information is immediately sent to the attached serial or parallel printer. Only if the printer cannot keep up with the data flow is the buffer used.

Because of this scanning system, only one input port can be active at a time. The FSU-81B resumes its scan for the next active port only after data flow from a selected port has been completed for a user-determined time (which can be set to 0.25, 1, 2, or 5 seconds by a DIP switch). While the FSU-81B allows you to configure all communications parameters of its eight inthing the communication of the second of the but rate, parity, wold length, number of stop bits, and handshaking, all input ports must be configured the same. The settings



EasyPrint is a software-only product that uses memory-resident programs to capture information directed to the various printers and reroute it to the serial connection leading to the hub.

That Was Then And This Is Now



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You remember when we first came out with WordStar From day one it became, as some described it, a classic. Over one and a half million of you snapped it up.

But that was then and this is now. And now there's a new WordStar WordStar Professional Release 4 for the IBM PC and compatibles. With the same familiar command sequence and file format you've grown to love. Yet with all the improvements you've

been asking for.
You're going to have a field day.

With over 125 new features, it's like a wish list come true.

Imagine, a WordStar Professional with, increased speed, undo, keyboard macros, Word Finder" Thesaurus, line/box drawing, improved printer support, multi-line headers and footers, and onscreen boldface/underlining.

nd onscreen boldface/underlining, Catch your breath. We're not done. There's also 14 function math, subdirectory support, go to page, and an improved spelling correction and Mail-Merge. There's even an optional 40 function key interface. Not to mention over 100 other enhancements.

And it's got people in the know talking.

in the know talking.
People like Michael J. Miller of
InfoWorld,* who described WordStar
Professional Release 4 as "faster than
ever" and "good enough to cause a

CIRCLE 502 ON READER SERVICE CARD

There's even more good news. If you already own WordStar or Word-Star Professional, \$89 and your present serial number let you update to Release 4. We've even included an order form below. It's our way of introducing a new dedication to our customers. It's out you do saying there's a new MicroPro.

WordStar Professional Start Professional Professional Start Professional Start Professional Pro

fessional Release 4. Let's hear it for new beginnings.



'ordStar revival"	*February 36, 1987 ma	
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■ PRINTER-SHARING DEVICES



ly, and output can be switched by embedded CROLE 601 ON READER SERVEY CARD of the output port are independent.

control codes.

Both the serial and parallel output ports can be used independently to connect two printers to the PSU-81B. The active port is selected through commands embedded in the data bound for the printer.

The 31/2- by 12- by 81/2-inch rectangular metal case is finished in a moderate beige, and the front and back panels are black. Three user controls are available on the front panel: Clear, which ends the current print job; Pause, which temporarily interrupts the current print job; and TOF, which

sends a top-of-form command directly to the printer (for instance, to put two printscreen commands on separate sheets).

Two banks of red LED indicators also decorate the front panel. One group of three LEDs monitors the status of the PSU-81B, indicating whether the printer is online and ready, the amount of buffer memory in use and whether the buffer has been completely filled. Another set of eight LEDs indicates which input port is active.

Eight female DB-25 connectors on the rear panel are provided for input, hardwired as DTE so that connection to a PC will require a null-modern cable. The serial output, configured as DCE (so it will plug into a serial printer with a "straightthrough" cable) uses a male DB-25 connector, and the parallel output uses a fe-

male 36-pin Centronics-style connector. Modes of operation and the serial communications parameters are set using a DIP switch bank that is accessible through a cutout in the rear panel. The PSU-81B has an internal power supply and plugs directly

into any standard wall outlet. Most of the limitations of the PSU-81B will be eliminated with the introduction of its successor, the PSU-81C, which will allow multiple input ports to receive data concurrently, permit individual configuration of each input port's serial communica-



Logical Connection

Selecting a printer-sharing device is mostly a matter of matchine your needs to an available device. Count up the number of PCs and printers you have check the types of ports they use, and then find a unit that will handle everything. If your needs are modest, a manual switch box from a reputable maker such as Black Box Corp. would suffice.

When your needs are ever changing, however, flexibility should play a key role in your selection. Knowing that PC installations change more often than seasons or even moods, we'd opt for the most flexible device we could find. Thus, because of its versatility and modest price, we'd choose Fifth Generation Systems' Logical Connection.

The Logical Connection offers the versatility of a printer-sharing device with the added benefits of a large print spooler and networklike abilities to send files between PCs. Its combination of parallel and serial ports means that you can match it to just about any printer or system. And its price is little more than that of a simple buffered automatic printer switch.

Rose Electronics' Caretaker Plus CTP-8P/256 has a lot going for it: parallel input and output, concurrent arbitration of its input, automatic output switching, ease of setup and use, and affordable cost: however, the static partitioning of its memory buffer is a dated ap proach. With dynamic partitioning

it would be one of our top choices. internal buffer. Although scheduled for re-

lease in March, the new unit was not available for review at the time of writing. Winn L. Rosch is a contributing editor of PC Magazine.



Only one of the Western Telematic PSU-81B's input ports can be active at once. It scans for the next active port after data flow from a selected port has ended for a user-determined interval.

Hang Up The Phone, Cancel Your Meetings, Forget Your Memos. Start Communicating.

You could spend your whole day just attempting to communicate. Playing telephone tag. Running back and forth to meetings. Toiling through mountains of memos. Just like millions of frustrated executives do every day. Or you could stop attempting and start communicating.

Introducing The Coordinator System.*

The Coordinator System is workgroup productivity software that streamlines communications between you and the other members of your group or department. It provides tools for thinking and planning to effortlessly bring together your team's goals, actions and followup activities.

Developed by Action Technologies, Inc., and adapted for NetWare IAN systems, The Coordinator System gives you immediate access to records of your conversations, project reports, and a daily calendar. It tracks any requests or commitments you make, and as your plans evolve it automatically informs others of changes that affect them. This minimizes forgotten commitments, miscommunication and wasted time.

Through LANs, bridges and phone lines, The Coordinator System can connect users worldwide, reducing reliance on overnight mail, couriers, telemail and telex. Yet the average cost of a communication is just five cents, including equipment and carrier costs.

A New Class of Software.

The Coordinator System delivers on PCs today what costly mainframe office automation systems promise—productivity. And at a fraction of the



cost. Companies already benefitting from this new class of PC software include GTEL, TRW, Du Pont, and, not surprisingly, Novell.

Running with NetWare, the Coordinator System capitalizes on the connectivity of LANs to streamline communication as never before. For a demonstration or more information, visit your Authorized NetWare Dealer, or call 1-800-LANKIND.

NOVELL.

Milestones Ahead.
CIRCLE 181 ON READER SERVICE CARD

If only there were more of you.



great if you could multiply yourself? Do an honest days work before lunch?

Microsoft* Windows Windows lets you

work with multiple applica tions at the same time -more programs than

your PC's memory can normally hold. Neatly sidestenning the 640K limit.

You can switch from, say, 1-2-3" to dBase II" or to Microsoft Word or to Microsoft Chart in a couple of keystrokes. Leave one program and jump to another.

And you can select and edit information from several different programs. Then quickly combine and print it all on a single piece of paper.

We've only just begun.

Windows is a graphic extension of MS-DOS* which gives you a more intuitive way to work. Your bridge to a new generation of applications which can be easily integrated. And which take

advantage of Windows' common interface for commands, options, and data exchange.

In the Windows world, you move information freely. Do more work, more kinds of work, and do it faster

A startling value.

Buy Windows now and you get a whole desktop full of applications to help you manage your day to day business.



In addition, you get Windows Write, a graphically-based word processing program. And Windows Paint, a simple, easy to use drawing program. Not bad for \$99.

Find out how productive you can be with a Windows office. Get all of yourselves down to

your Microsoft dealer. And take a really good look into Windows.

The High Performance Software

For the name of the nearest Microsoft dealer, call (800) 426-9400, In Washington State and Alaska, (206) 882-8088. In Canada, call (416) 673-7638. Microsoft and MS-DOS are registered trademarks of Microsoft Corporation. 1-2-1 is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development (II is a registered trademark of Lotus Development Corporation d'Bine II is a registered trademark of Lotus Development (II is a registered trademark of Lotus Development Corporation d'II is a registered trademark of Lotus Development (II is a registered trademark of Lotus Note: Photos show color and resolution obtained on an IBM PC equipped with an IBM Enhanced Oraphics Adapter Monochingan display is generated when an IBM Colon/Graphics Adapter or compatible graphics adapter cost is used

"A PC MAGAZINE" RETROSPECTIVE

hew! We've described, evaluated, and tested 13 local area network products since we began
work on our first special LAN Issue [PC-Magazine, Volume 5 Number 21]. The
LANs we've examined over the past 5
months are products of well-known companies like 3Com Corp., Texas Instruments, Novel, IBM Corp., and AT&T Information Systems and of small start-up of
conversions of the start of the st

We ve teamed a lot.

One of the things we've discovered is that looking at LANs today is a little like looking at the automobile. 30 years ago. Then car makers had developed a good automatic transmission, and designers were experimenting with tail fins and guilons on the basis of price, performance, their tests in the dealer, or the recommendation of a friend who bought a certain brand or model and had eood lack with it.

Similarly, today the visible differences between the top dozen LANs are in their tail fins and elapsed time in the quarter mile. LANs have major differences under the hood, but those are for engineers and

■ CONNECTIVITY ■

CONNECTIONS 13 LANs In Perspective

Over the past 5 months we've reviewed and benchmark-tested a total of 13 LANs. The time has come for us to show you how these LANs fit into the big picture. Here we discuss the issues and how the various products reviewed fill different bills.

FRANK J. DERFLER, JR.



The LAN-Topology Lineup

Neworks operate with very different combinations of electrical and physical topologies; a LAN that uses a given physical topologies, by circitations, is not thereby limited to a single corresponding electrical arrangement. Systems in which the station cables physically terminate in a nich can be single or an object about on a not can be single or an electrical arrangement of the property which would seem to be the most oppology, which would seem to be the most oppology, which would seem to be the most oppology which would seem to be the most oppology which would seem to be the most oppologies why to write an electrical ring, is not used in any of the products reviewed that have an electrical ring, is not used in any of the products reviewed.

		PH	YSICAL TOPOLO	GY
_		Hub	Station-te-station	Trunk and
OFOLOGI	But	Standard Microsystems' ARCset AT&T's StarLAN	Invisible Network AT&T's Start.AM Fox Research's 19-RET 3Com's Ethernet	Galewa Orchid Techr Texas In Business-Pr Standard M AR
ELEC I HICAL I OF	Ring	Proteon's ProMET-10 IBM's Token-Ring Network		3 Com's
ELEC	Poiling	Novell's NetWare/S-Nat		

vote: Taligrass Technologies' LanCourier topology depends on the network interface card used with it.

screwdriver turners to worry about. Serious LAN buyers find that, as with cars, factors such as price and dealer support are more important than technical design points like what media sharing protocol the LAN uses.

Here we describe what we have learned from our in-depth look at LANs. First we present the hardware design alternatives—Proken down into wiring, topology, access protocol, and interface cardand how these alternatives affect the selection, installation, and operation of network systems. Then we look at the options in network servers. Finally, we examine networking software.

This summary of our findings brings all these considerations to the forefront—to bring you up to date on the state of the art of PC LANs and to help you select one that meets your needs.

WIRING The first design alternative for network hardware that we will consider is wiring. The cables used to connect stations in a local area network almost always use copper wire. The copper wire in network cables can be arranged in one of two ways: twisted together into a pair or molded into a shielded oraxial cable.

Coaxial cable has a reputation for gen-

erally being difficult to install, and companies like AT&T and Fox Research promote the advantages of reusing the twisted-pair telephone wiring already in the walls. We found that neither the reputation nor the advertising for using twistedpair telenhone wire is always true. Al-

 If you can use existing twisted-pair telephone wiring, you will save money, and it probably won't limit the system's

though the ability to use existing telephone wiring might be appealing, it may be impossible in your case, either because the existing wire doesn't go to the right place in the right way or because it really isn't twisted. In both instances, you'd have to install new wiring.

Some systems, such as an expanded

operational effectiveness.

version of AT&T's Start.AN and IBMs 5 Token-Ring Network, require that the cabling go from each network station to a hibb at a central point. They also impose a limitation on the total length of wire that can be used between the station and the hub. If the existing wiring doesn't come together in a single place within the specified distance, you can't use it in those sys-

In contrast, smaller StarLAN systems, 10-NET, and the Invisible Network use a station-to-station wiring scheme. This arrangement doesn't require as many free pairs of wire as does the hub arrangement, but the pairs that are used must appear in every room in which a station is to be placed.

Also, not all telephone wiring is twisted pair. In true twisted-pair wiring, the twisting of the wire furnishes an electromagnetic cancellation that prevents the wire from radiating or absorbing electrical energy. Our tests on networks using true twisted-pair wire showed them to be highly resistant to interference from nearby sparking motors and VHF radio transmissions from a broth-belt radio.

Wire that was installed to extend older telephone systems, called key systems, and the common "house wire" used in



Networking Software: Summary of Features (Listed in ascending price order)

Natworking software is the tool not of network users but of network administrators, who use it to satisfy the needs of network users. The best networking software packages offer similar performance. The differences between the programs generally come down to the features and accessory programs such as menus, mast, chat, and network reporting. The packages are all

relatively easy to install on the server; the difficulty of setting up users depends on the number of utilities you install and features you implement. For an in-depth description of the method used to evaluate each feature, see "Making Connections: LANs Under Netware" PC Meazzine. Volume 5 Number 21.

Software Manufacturer List price	PC Local Araa Network Program IBM Corp. \$125	Start AN Network Program AT&T Information Systems \$125	10-NET Fox Research Inc \$695*	3 + Shara 3Com Corp \$895	VINES Banyan Systems Inc \$1,895	Advanced NetWare/286 Novell Inc. \$2,195
INSTALLATION						
Tureksy Meny-drives lestellelies						
Ocumentation					N/A	
NETWORK Administration						
Hours per month	1.00	1.00	0.75	1.00	1 25	1.25
Stetue reporting						
Security						
Workstation operation						
FEATURES						9
Statios-to-statios lile transfer						
Printer opooling quouing Paer-la-peer communications						
Network dial-in	•	-0.				
COMPATIBILITY						
RAM-resident soltwere						
Smort activers						
dBASE III Plus	•					
A hose Series 5000	-	-		100	-	
	software is preinstalled on set tion package, software is not	9000		Poor	11	

residential telephone systems probably are not wisted. This means that the electrical noise on the wire will quickly overcome the desired signal and the wire cannot be used for systems like StarLAN over any appreciable distance. (Interestingly, Fox Research's 10-NET can be used effective by over untwisted telephone house wire, although twisted-nair wiring is notereable.) The widely held belief that twisted-pair wring is less expensive and easier to install than coaxial cable isn't necessarily true either. Much of the common "wisdom" surrounding coaxial cable was gained through exposure to the large-diameter cable used in inks from mainframe computers to terminals. However, the co-ravial cable used in systems such as

3Com's Ethernet and Gateway Communications' G/NET is smaller than most twist-

ed-pair cables and easier to install.

Our experience with cabling boils down to this advice: If you can reuse existing twisted-pair telephone wiring, you will certainly save money, and the existing wiring probably won't limit the system's operational effectiveness. But if you cannot

reuse such wiring, the decision to install new coaxial cable or new twisted-pair wiring is one of the last things you should worry about. Almost all the other factors that affect your selection of a LAN are more important, from the cost of the network interface cards to the availability of vendor support.

(Note: We haven't tested any fiber-optic cable systems, although both Proteon and Fox Research market fiber-optic versions of their network interface cards. Since the IBM standard cabling scheme includes fiber optic cables, the product managers at IBM certainly must have plans to release more networking devices that transmit and receive with light. We'll look at them as they arrive on the scene.)

TOPOLOGY Another hardware design consideration is the topology. The phrase "network topology" refers to the shape or geometry of the network.

We described two topologies, electrical and physical, in every review of every LAN we looked at since our first LAN issue. These topologies can be very different from each other. Among the many possible electrical topologies, the LANs marketed for personal computers primarily use the bus or the ring, with the bus predominating. In fact, every network we evaluated except the IBM Token-Ring Network and the 3Com Token-Ring used a common electrical bus between stations

The electrical bus topology is designed so that every station receives every signal generated on the network media. In the electrical ring topology, the signal is actually regenerated and repeated as it is passed from station to station.

However, the ring and the bus electrical topology can have one or both of two very different physical topologies. In each electrical topology, you can choose between running cables from station to station and bringing one cable from each station back to a central point called a wiring hub. The station-to-station and hub (also called star) physical topologies predominate in PC IANE

The station-to-station arrangement of Gateway Communications' G/NET, 3Com's Ethernet, Fox Research's 10-NET, and other systems uses less wire and may be easier to install, but if the cable An advantage of the hub physical topology is that one bad cable or connector normally will not disrupt the network.

fails because of a bad connector or damage at any point along the way, the entire network goes down. The advantage of the hub arrangement of Proteon's ProNET-10. Standard Microsystems' ARCnet, IBM's Token-Ring Network, and other systems is that one had cable or connector normally will not disrupt the network, and if it does, you can quickly restore the system by unplugging the bad cable from the hub.

Our advice is that the topology of a network should be a major consideration only if you need extremely high reliability. You have to decide if the added cost of one or more network hub devices (usually costing hundreds of dollars each and canable of handling a limited number of stations) and additional cable is worth the improved network reliability.

If your network is supporting manufacturing, security, medical, or on-line money-making applications, the additional cost is probably justified. But if you are using the network to transfer word processing documents in an office, the cost advantages of station-to-station wiring can be significant.

ACCESS PROTOCOL Access protocol is another design alternative of LAN hardware. The two protocols of the PC LAN marketplace are the carrier sense multiple access (CSMA) protocol and the tokenpassing protocol.

The LANs we reviewed are all in a class called media-sharing local area networks. with the single exception of Novell's Net-Ware/S-Net. NetWare/S-Net provides each terminal with a dedicated link to the server, which is combined with the wiring hub in a single cabinet. In media-sharing LANs, the wire that is used to carry the sig-

nals is connected to every station, and the stations must use a protocol-either the CSMA or the token-passing protocol-that determines when they may

transmit a message. CSMA is a listen-before-transmit protocol that works like a citizens band radio channel. Under the CSMA protocol, a station may begin to transmit a message if the channel is clear of traffic. However, it is possible that two or more stations may detect a clear channel at the same time and begin transmitting together. If this happens, their messages collide and become garbled. Various techniques can detect or avoid these collisions. Perhaps the most unique is the one the Invisible Network uses, called Heartbeat Collision Avoidance. This technique sends a timing signal on a separate set of wires; a station may transmit during a certain time slot only if the channel is clear. The majority of the networks in the marketplace, including Ethernet, StarLAN, 10-NET, and many others, use the CSMA protocol.

In contrast to the CSMA protocol, the token-passing protocol prohibits a station from transmitting until it receives a specific permission message, or "token," Although Standard Microsystems' ARCnet, IBM's Token-Ring Network, Proteon's ProNET-10, and 3Com's Token-Ring differ in their electrical topology, physical topology, and network media, they all use some variation of a token-passing protocol

to access the media.

The advantage of the CSMA system is that it is able to handle short messages quickly and efficiently. The disadvantage of the CSMA system is that a station with a long message or many messages to send can easily monopolize the network. Token-passing systems, on the other hand, theoretically put more overhead into the network and are not as efficient for handling many small messages. Yet tokenpassing protocols give every station an opportunity to transmit their messages on a regular basis.

The media-sharing protocol you choose is slightly more important than, and closely linked to, your choice of physical topology. The same types of considerations apply. If you are supporting manufacturing, security, medical, or other critical applications, you should give strong considerNow Shipping NTNX... Network-Compatible Software

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Possible by Alloy The PC-PLUS family turns your single IBM personal computer or compatible into a fully integrated office solution. Up to 31 users can be added to the host - while maintaining full functionality of the PC. As needs grow, add more PC-SLAVE/16 cards and

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ation to selecting a token-passing protocol. If you are in an office or work-group environment, selecting a system using a CSMA protocol may give you slightly improved response time with some applications and lower cost.

INTERFACE CARD Another hardware design alternative is the network interface card the LAN uses. Two network interface cards using the same media, arranged in the same topology, and using the same access protocols can still have some major differences between them.

Some modern cards, such as 3Com's TokenLink Plus, 3Com's EberLink Plus, and IBM's Token-Ring Network, have connectors that mate with the special expansion slots of the PC AT. These connectors allow the cards to make use of the fastering the special power of the special expansion slots of the PC AT bus. Using these cards to make use of the fastering that the special power of the specia

Interface cards equipped with powerful processors can also speed up a LAN. IBM's Token-Ring Network and 3Com's Tokenl ink Plus cards have their own 80186 processors, RAM, and programming in ROM. Gateway Communications' G/NET cards have a fast Z-80 processor. Selecting network interface cards with a processor more powerful or faster than the 8088 in the typical PC might sound unusual, but if the processor on the interface card unloads work from the PC, both systems benefit. However, since powerful interface cards such as 3Com's EtherLink Plus sell for several hundred dollars more than less-powerful alternatives, putting them into every workstation may not be practical.

Several manufacturers of network interface cards, including Gateway and inverted cards, including Gateway and inverted cards, including Gateway and entertwo knowskation to boot without using a local disk drive. Invisible Software includes this feature as a standard part of its relatively inexpensive cards. When a workstation PC's interface card is equipped with one of these ROMs, the PC uses the network to reach the server's hard eight and the property of th

This feature is desirable if you want to use diskless PCs as network workstations.

LAN PRODUCT INFORMATION

SOFTWARE:

Advanced NetWarel86 Advanced NetWarel286 SFT NetWare Novell Inc. 122E. 1700 South Provo, UT 84601 (801) 379-3900 Pricess Advanced NetWarel86, \$1,595; Ad-

vanced NetWare(286, \$2,195; SFT NetWare, \$2,995.

Requires: 40K RAM, DOS 3.1.

In Short: A well-integrated and advanced LAN software system that contains features cher vendors are still struggling to develop. Not copy protected.

ORCIE \$840 PRACES SERVE CAND

PC Local Area Network Program
IBM Corp.
Old Orchard Rd.
Armonik, NY 10504
(914) 765-1900
Prices \$125
Requires: 256K RAM, DOS 3.2.
In Short: Easy to install and maintain. Although it has a good station-obstition message utility, the program cannot send storestage utility, the program cannot send store-

and-forward electronic mail. Its security and troubleshooting features do not compare well with those of other popular networking programs. Copy protected.

ORCLESSION READER SERVICE CARD

StarLAN Network Program

AT& T Information Systems
395 M. Maple Ave., 487-2226F2
Basking Ridge, NJ 07920
(201) 221-8851
Prices 1325
Roughest State Stat

ware performance in the PC Labs benchmark

tests. Not copy protected.

DECEMBER SPACES SPACES SPACES

10-NET

FOR Research Inc.

7016 Corporate Way

Dyston, DH 15459

(513) 433-2238

Prices 10-NET installation package (including network interface board, tap box, 8-foot

connecting cable, documentation, and the the 10-NET software), \$695. Requires: 124K RAM, one disk drive, DOS

2.0 or later.
In Short: 10-NET offers many features while retaining ease of use and installation. Its security and station-to-station communications features are particularly strong, as is its status reporting. The installation process is not complex, but it requires you to create batch files for every user and workstation on the

network. Nol copy protected.
CRCLE 448 ON READER SERVICE CARD

3+Share
3Com Corp.
3165 Kifer Rd.
Santa Chan. CA 95052

(408) 562-6400
Prices: 3+Share for PC servers (maximum five users), \$895; 3+Share for PC servers (unlimited number of users), \$1,790; 3+Share software for Sterver3 (unlimited number of users), \$1,790;

Requires 600K RAM, DOS 3, or later, 18 miles of 18 mil

CIRCLE 607 ON READER SERVICE CARD

VINES Banyan Systems Inc. 115 Flanders Rd. Westborough, MA 01581 (617) 366-6681

(617) 303-0851
Price: \$1,895 (including Network Administration).
Requires: \$12K RAM (1 Mbyte RAM rec-

commended), DOS 2.0 or later.

In Short: VINES is extremely flexible and has powerful communications capabilities.

The troubleshooting and displays are excellent. The system's see airly flexible made but access permissions for network users could be more flexible. Copy protected.

EMPLE 410 DRE-LEMI SERVICE LAND



If you own two or more PCs then you need EasyLAN" version 3.0.

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EasyLAN shares printers and disk drives between IBM PCs. EasyLAN can save you \$1,000 or more per PC by eliminating duplicate equipment purchases.

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applications for EasyLAV and other NETBIOS com

EnsyLAN VERSION 3.0 HIGHLIGHTS EnsuL4N shares printers, plotters, data,

- Supports up to 18 PCs or compatibles New Network Commands
- New NETRIOS
- PC to PC file transfer Print speeling
- PBX sun
- Easy to install
- Easy to operate

Earn/LAN's low price matches the small business user's cost sensitive budget. It is the office network solu tion for less than \$100 per PC.

EasyLAN performs its operations concurrently in the background. EasyLAN communications, file transfers and printer operations all take place while each PC simultaneously performs such normal DOS applications as Lotus 1-2-3," Wordstar," and dBASE."

NEW NETRIOS SUPPORT....WRITE YOUR OWN. COMMUNICATIONS PROGRAMS. immers may use EusyLAN to develop network

applications using NETBIOS (interrupt Sc.) These appli rations can now be operated across the low cost RS 232 mmunications links used by EasyLAN Our new EnsyCALENDAR program is an example of a network application that uses NETBIOS for program to program

require a high overhead network operating system will erform faster on high-cost networks operating at mega-

NEW VERSION 3.0 COMMANDS EXPAND NETWORK PLEXIBILITY

EZCLOCK lets PC's attached to the network read the time and date from a single master clock on the central PC. eliminating the need to install individual clock boards in

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when it comes to managing subdirectories on the central EZBEEP lets you send an audible signal across the network, alerting a PC user that a file or message is being

SULAY PRX SUPPORT BRINGS NEW FLEXIBILITY TO PC CONNECTIVITY

With EssyLAN's PBX support, users can share peripher als and transfer files using PBX switched-circuit connec tions and existing twisted-pair wiring. Easy/AV has already been installed on a number of different PBX's, and ndy been instance on a framer of the comforuse on its cently was certified by Northern Telecom for use on its

EasyLAN—Networking With Netbios Support. And it's Only \$99.95 Per PC.

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Disk sharing uses EasyLAN's EZCOPY com mand to move files to and from PC's. ASCII or binary files can be transferred in the foreground, or in the background while other DOS programs run

Printer sharing operates transparently with existing programs. Print files are automatically spooled to disk and scheduled for printing. Multiple nrinters on the central PC may be designated for individual printing tasks.



EasyLAN Office Network

EasuLAN SPECIFICATIONS Each PC in the network requires an individual li

censed copy of the EasyLAN program and takes 20k of memory on each satellite PC, a serial port, and DOS 2.0 or above. EasyLAN runs on all IBM PC models and compatibles. The central PC requires a serial port for each satellite PC. The COM2 and COM6 boards are serial port expansion boards which permit you to add serial ports to the central PC.

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EasyLAN can be installed in less time than it takes to enjoy your coffee break. Just plug the EasyLAN cables into existing serial ports. The EasyLAN Network Configuration Program provides menu driven installation program that will guide you step by step through the software installation process.

EmpCALENDAR-USE YOUR NETWORK TO SCHEDULE MEETINGS The first of a new series of Easy network application

products using NETBIOS is now available Earn CALENDAR handles time management applications for individuals or a department and can be run on personal computers attached to any NETBIOS computable network

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TODAY'S NEWS for broadcasting messages, notices or

MENU INTERFACE for easy set up and us EnsuCALENDAR's Data base for appointments, to do lists. and news resides on the central PC Satellite PCs at tacked through EasyLAV version 30 send network transactions to the central data base to invoke Eggs

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vance orders are being accepted now I bought access to a laser jet printer for less than \$100.

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-1516 In CA 408/738-8377		

syLAN (Order i	Form			
15	Item	Description	Price	Qty	Ажок
uestions	ELes	EasyLAN Kit—for 2 PCs 30' cable, two disks & manuals	\$219.96		1
elv	EL 03	EnzyLAN Expansion Kit-for I-PC 30'	\$119.95	_	s

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The Differe Networking A

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systems engineer.

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A Different Kind of Computer Company CIRCLE 353 ON READER SERVICE CARD



LAN PRODUCT INFORMATION

LANs:

ARCnet

Standard Microsystems Corp 35 Marcus Blvd. Hauppauge, NY 11788 (516) 273-3100

Workstation Requirements: 256K RAM, DOS 3.1 or later. Networking Software: Advanced Net-

Ware 286, Viamet.

Prices: ARC net-PC100 interface board,
\$545, ARC net-PC200 interface board, \$595;
\$ARC net-PC200 interface board, \$1, 295;
\$ARC net-PC300 interface board, \$1, 295;
\$ARC net-PC110 interface board, \$595;
\$AC net-PC210 interface board, \$595;
\$Active Link (fiber-optic board), \$375;
\$Active Link OPT (two-port active bub for PC200),

\$1,295, four-port passive hub (for use with PCOO), \$100, cjhh port active hub, \$885. In Short: ARCnet performed the best of the revewels tested that used an AT as server, although under increasing network load, its throughput made electics slowly, it is a lessible system that lets you start small, but adding whing hub's gives you room for great expansion.

Business-Pro LAN Server

Texas Instruments
Data Systems Group
P.O. Box 809063
Dallas, TX 75380-9063
(800) 527-3500
Workstation Requirements: 256K RAM,
one floppy disk drive, DOS 3.1.

Networking Software: Advanced Net-Warel: JT. Prices: TI Business-Pro computer (basic configuration), \$3,995; TI Business-Pro computer (including \$12K RAM, TI Mode CRT controller, 40-Mbyte hard disk drive), \$5,770; Advanced NetWarel: -TI, \$1,595;

two terminating resistors, 540. In Short: The Business-Pro LAN Server networks Texas Instruments' and IBM's PCs, allowing each to operatio in its attrive mode on the LAN. Although this LAN is slower than other systems, the server can carry heavy loads of hard disk, tape backup, and add-on peripherals. Although TJ provides carellent documentation, installation is complicated because you must et over 40 jumps on each because you must et over 40 jumps on each

CIFICLE 626 ON READER SERVICE CARD

Ethernet 3Com Corp. 3165 Kifer Rd. Santa Clara, CA 95052 (408) 562-6400

Workstation Requirements: 320K RAM, DOS 3.1 or later. Server Requirements: 640K RAM, DOS 3.1 or later.

Section Milling Software; J. + Sturr.

Prietes Education bounds, 5975 oach: reminator kin, 530, colole prices way depending on
length; + 34 haur for Pri Cerverse (manufacture), 1830; colole prices way depending on
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undimited auments of users), 51, 790;
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performs very usef on the Descriptor, 1830;
J. - Sharr so the Secreta's, 1831;
J. - Sharr so the Secreta's 1

also has the flexibility of the standardized Ethernet interface. CIFICLE 825 ON PEADER SERVICE CAPD

G/NET Gateway Communications Inc. 2941 Alton Ave.

Irvine, CA 92714 (714) 553-1555 Workstation Requirements: 128K RAM,

DOS 3.1. Networking Software: Advanced Net-Warei86, Version 1.02; NetWare 4.61B; Advanced NetWarei86; Advanced Net-Warei286; PC Local Area Network

Program, (requires GINETBIOS, a GINET NETBIOS simulator). Frieses. NetWare 4.61B two-node starter kit, \$1,895; NetWare 4.61B three-node starter kit, \$2,420; Advanced NetWare, Version 1.02, two-node starter kit, \$1,995; Advanced NetWare180, Version 1.02, three-node startrekit, \$2,520; Advanced NetWare180.

sion 102, three-node stater isi, 3.2.500, theunode stater isi, 3.2.500, theunode stater isi, 3.200, Advanced Net-Murcillo, Version 2.0, vib. or node stater isi, worstell, vib. or 10.4, vib. or node unter isi, worstell, vib. or 10.4, vib. or node unter isi, 2.00, three-node stater isi, 3.2.20. In Short c'NOTE i a good general-purpose network. It distinguishes isedi from other land of the properties of the properties of the gramma that steps on through the installation you would be a similar to the properties of the gramma that steps on through the installation you that the properties of the prop

CIPCLE 634 ON READER SERVICE CARD

IBM Token-Ring Network IBM Corp.

Old Orchard Rd. Armonk, NY 10504 (914) 765-1900 Workstation Requirements: 256K RAM.

DOS 3.2. Server Requirements; 256K RAM.

DOS 3.2. Networking Software: PC Local Area Network Program, Advanced NetWare, Tapestry, all other networking software that sup-

ports NETBIOS.

Prices: IBM Token-Ring Network Starter
Kit, \$4,065; PC Local Area Network Program, \$125; Adapter Cards, \$695; Multistation Access Unit (#8228 Setup Aid), \$660;
cabling prices vary among authorized IBM

In Short: An industrial-strength network system that is fast and flexible but lacks builtin troubleshooting and diagnostic reporting tools.

CIRCLE 633 ON READER SERVICE CARD

Invisible Network Invisible Software Inc. 481 47th Ave. San Francisco, CA 94121 (415) 221-0916

Workstation Requirements: 320K RAM (640K RAM recommended), DOS 3.1 or later. Server Requirements: 320K RAM (640K RAM recommended), hard disk, DOS 3.1 or

later. Networking Software: PC Local Area Network Program, Tapestry, Advanced Net-Warel86, Advanced NetWarel286, CBIS Network-OS.

Network (35.)

Friese Stater Kt. including two Invisible Network cards, 33-foot calloss, two copies of Network cards, 33-foot calloss, two copies of Network cards, 34-foot calloss, and the Network cards, 5249-95 each; additional resident Network cards, 5249-95 each; additional resident Network Code, 5249-95 each; additional resident Network (1864) and Advanced Network (1864) per site. In Short: The Invisible Network, using IBMN 3-CL Lead Network Programs and the power of NETBIOG, given you good per on a network with no more than a few dozen on a network with no more than a few dozen.

WORKStations.
CIPCLE 632 ON READER SERVICE CARD

LanCourier Tallgrass Technologies Corp. 11100 W 82nd St. Overland Park, KS 66214 (913) 492-6002 Wurkstation Requirements: 256K RAM (512K RAM recommended), one floroy disk drive, DOS 2 0 to 3.1. Networking Software: VINES

Prices: LanCourier TG-8000 server with 43-Mhyte hard disk without software, \$8,495; VINES (including NETMAN), \$1,895; 3Com's EtherLink cards, \$750. In Short: The LanCouner TG-8000 server combined with VINES makes a flexible and

powerful LAN with outstanding communications capabilities. CIRCLE 627 IN READER SERVICE CARD NetWare/S-Net Novell Inc

122 E. 1700 South Provo. LTI 84601 (801) 379, 5000 Workstation Requirements: 256K RAM, DOS 3.1

Networking Software: Advanced NetWare 68 Prices: Server 68B, \$8,000: network interface boards, \$250; NDS2 disk subsystems; 68-Mbyte disk drive, \$4,995; 109-Mbyte disk drive. \$6.495; 183-Mbyte disk drive. \$10,995; NDS4 disk subsystems: 68-Mbyte disk drive, \$5,595; 109-Mbyte disk drive, \$7,095; 183-Mbyte disk drive, \$11,495 In Short: NetWare/S-Net with Server 68B is a good, solid network for heavy-duty transaction processing. The server is a rugged, conservatively designed machine. NetWare/S-

Net is also quite a remarkably steady performer, showing little degradation from the lightest to the heaviest test loads. In addition, NetWare/S-Net is easy to install-except that the documentation neglects to mention that you must attach a terminal to the

CIRCLE 431 ON READER SERVICE CAR Orched Technology Inc 47790 Westinghouse Dr Fremont, CA 94536

(415) 490-8586 Workstatiun Requirements: 256K RAM,

Networking Software: Advanced Net-Ware/86, PCner, all other NETBIOS-compatible software, including PC Local Area Network Program and Tapestry

Prices: Two-user starter kit, including the

PCnet software, \$1,909; meluding Advanced NerWare/86, \$1,550; PCnet network inter face board, \$495; Conquest multifunction board with network daughterboard, \$795; 100 feet of cable, \$50; PCnet adapter cards,

In Short: Orchid Technology's LAN is easy to install and can adapt to the needs of individual systems. Its Conquest board could help those short on slot space. In addition, each PCnet network interface board comes with some useful software designed to circumvent hardware comention problems. It's not the fastest network around, but it should suffice for office and light transactional processing uses.

630 IN READ ProNET-10

Proteon Inc. 2 Technology Dr. Westborough, MA 01581 (617) 898-2800 Workstation Requirements: 256K RAM.

DOS 3.1. Networking Software: Advanced Net-Ware 86, Advanced NetWare 286, DECnet. TCP/IP, VINES Prices: n1300 network interface card, \$799. p1303 network interface card, \$899, eight-

node wire center, \$630; four-node wire cen-In Short: The ProNET-10's adapter cards are easy to install. Small networks can be set up without problems, but networking more than 12 workstations is unduly complicated. Another plus: LEDs next to the connectors glow when an electrical connection is made. which helps in network troubleshooting.

CRELL 629 IN PEACER SERVICE DARS

StarLAN

AT&T Information System 295 N. Maple Ave., #17-2326F2 Basking Ridge, NJ 07920 (201) 221-8851 Workstation Requirements: 256K RAM. one floppy disk drive, DOS 3.1 or later

Server Requirements: 512K RAM, bard Networking Software: StarLAN Network Program, Advanced NetWare: 86. Advanced NetWare 286.

Prices: Network Access Unit Interface board, \$595, 300 feet of cable, \$23: 1,000 feet of cable, \$55.

In Short: StarLAN is an easy-to-install, flexthle network for future expansion, but the 6300 server is inadequate, and StarLAN Network Program, while easy to use, is slow CIRCLE 636 ON READER SERVICE CAR

10-NET, Version 3.1 Fox Research Inc 7016 Corporate Way Dayton, OH 45459

Workstation Requirements: 192K RAM. one floppy disk drive, DOS 2.0 or later. Networking Software: 10-NET Prices: 10-NET installation package (including network interface board, tap box, 8-foot connecting cable, the 10-NET software, documentation), \$695, twisted-pair telephone winng, \$120 per 1,000-foot roll In Short: 10-NET includes everything yo need for a workstation node in a single pack-

age. The 10-NET software includes features such as a public calendar and chat capabilities that are optional or nonexistent in other networking software packages. This is a good package for office or university environments that require such software features However, the network's slow speed makes it

inappropriate for DBMS applications that need fast transaction processing CROLF 635 ON READER SERVICE CAR

3Com Token-Ring 3Com Corp 3165 Kifer Rd

\$5,995

Santa Clara, CA 95052 (408) 562-6400

Workstation Requirements: 320K RAM. DOS 3.1 or later Server Requirements: 640K RAM, DOS 3.1 or later

Networking Software: 3+Share. Prices: Starter Kit (including three Token Link Plus network press adapters, three Ring-Taps, two trunk cables), \$3,755; 3+Share for PC servers (maximum five users), \$895; 3+Share for PC servers (un of users), \$1,790; 3+Share for 3Server3 (unlimited number of users), \$1,790, 3Server3,

In Short: This network pays attention to detail with large captive screws on the connectors, and you can add stations to the ring without buying another network hub. The TokenLink Plus cards with the 3Server3 would make a particularly good network for applications that require every workstation to communicate during the busiest times

Toshiba Mak Out Of Your

RESERVI WAITING

The more advanced something is, the simpler it should be to use. That's exactly what we had in mind when we designed our new printer, the P321SL. It doesn't just look sophisticated, it makes turning your hard work into hard copy a lot easier.

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The more advanced something is, the ler it should be to use. That's exactly we had in mind when we designed triving to find and switch dips witches any

more. There aren't any. The P321SLS front panel lets you choose type fonts, pitch, emulation, quiet mode, lines per inch, page length and more at the touch of a button.

Compatible as it is with you, the new P321SL is also compatible with IBM Pro-

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printer! Qume Sprint 112 And of course our own P351. These emulations, in addition to five resident fonts, optional plug-in type font cards and downloadable type fonts.

give you a lot to choose from. Without a lot of work. There's another

thing the P321SL gives you less of options. That's be-

cause it comes with more standards like the tractor, quiet mode and IBM emulation.

Also standard is our excellent 24-pin print quality that's head and shoulders

This is Toshiba 24 pin letter quality.

This is 9 pin printer quality.

above 9-pin heads. (Made even better with Toshiba's letter-quality multistrike film ribbon.) And high-resolution graphics. So really the only other options to consider are the sheet feeder and larger memory.

That should make choosing the affordable P321SL as easy as using it. For the name of your Toshiba printer and computer dealer call 1-800-457-7777.



In Touch with Tomorroy



Benchmark Tests: 13 LANs

This test stresses the network interface card in the server and the media-sharing protocols. Systems are issed from slowest to bisset according to their performance numering four stations. The token media-sharing protocols used by AFCnet and their Bell Token-Ring (Menkork Cow self in this set and show a relatively small amount of speed degradation because network of their self-should be self-

Network Speed Under Contention

Performance Times

System/Masufacturer	Interface cerds	Settwere	Server	Zaro statione	Ose station	Two stations	Three stations	Four stations	
10-NET/Fox Research Isc.	10-NET	10-NET	All workstations	82 44	150.32	223 43	295 22	392.33	Ī
PCnet/Orchid Technology Inc.	PCnet	Advanced NetWare 85	8-MHz IBM PC AT	67.50	140.37	225.22	245.63	279.55	Ī
Invisible Network/Invisible Software Inc.	Invisible Network	PC Local Area Network Program	8-MHz IBM PC AT	75.00	93.00	127.00	159.00	233.00	Τ
Start AM/AT&T Information Systems	StarLAN	Start AN Network Program	8-MHz IBM PC AT	105.49	118.58	149.61	160.00	188.51	
Ethernet/3Com Corp.	EtherLink Plus	3 + Share	8-MHz IBM PC AT	51.00	87.00	110.00	140.00	170.00	ī
Business-Pro LAN Server/Texas Instruments	EtherLink	Advanced NetWare/E-TI	TI Business-Pro	41.11	68.07	109.87	129.49	153.48	
G/NET/Gateway Communications Inc.	G/NET	Advanced NetWare 85	8-MHz IBM PC AT	54 65	74.20	85.84	106.25	134.20	
ProNET-10-Proteon Inc.	ProNET-10	Advanced NetWore 286	8-MHz IBM PC AT	58.96	64.46	68 60	92.25	124.27	
3Com Yeksn-Ring/3Com Corp.	TokenLink Plus	3+Share	3Server3	52.00	58.00	70.00	90.00	117.00	Ξ
NatWere S- Net Novell Inc.	NetWare/S-Net	Advanced HefWare 68	Novell Server 688	71.00	83.70	94.29	103.71	115 68	
IBM Tekes-Ring Hetwork/IBM Corp.	IBM Token-Ring	PC Local Area Network Program	8-MHz IBM PC AT	63.68	71.54	83.47	97.41	110.73	
Ethernet/3Com Corp.	EtherLink	3+Share	3Server3	44.00	54.00	66.00	78.00	97.00	Ξ
StarLAN/AT&T Information Systems	StarLAN	Advanced NetWare/286	8-MHz IBM PC AT	58 41	70.12	75.68	81 86	93 46	ī
ARCset/Standard Microsystems Corp.	ARCnet	Advanced NetWhre 286	8-MHz IBM PC AT	59 45	62.14	67.83	78.21	92.56	
LenCourier/Teligrass Technologies Corp.	EtherLink	VINES	LanCourier TG-8000	38.81	58.60	74.86	85.07	91.23	Τ
ISM Token-Ring Network/ISM Corp	IBM Token-Ring	Advanced NetNare 286A	8-MHz IBM PC AT	55.83	60.16	64.10	73 29	79.52	ī

The PC Labb benchmark tests were run using three BIM PCs, one PC-XT, and one PC AT as workstatione. The load provided by these station is heavier and mora consistent has that found in normal office or data processing applications. Therefore, the results of these tests can be interpolated to networks with a larger number of workstations but with a more spondarie workload. The default server for these tests is an BIM PC AT running all 8 MHz. When a network systam for

IBM PC AT contains only ST2K bytes of RAM, and we lound that that limitation degrades some performance times in comparison with other servers tested with more memory. For the sake of consistency, we tested he network systems, whenever possible, running the appropriate version of Novell's MertiNer. We also tested the systems running under any proprietary or other software from the pestern's version. Timing on these tests was done through the use of a separate clock not on the computer motherboard and therefore not subject to interruption by programs that disable interrupts.

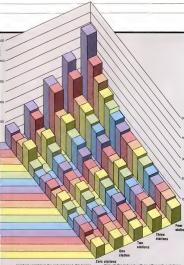
Programs that obsobe interrupts.

For the Network Speed Under Contantion benchmark text, the dependent variable is the time it took for the IBM PC-XT on a LAN to perform a standard set of DOS reed-writs commands against a singif data like residing in the server. The Inde-

(Diskless PCs will be reviewed in an upcoming issue of PC Magazine.) Using a diskless PC reduces the cost of each workstation and improves network security since users cannot make a copy of a program or data file on the local disk drive and walk away with the floppy disk. All possible combinations of processor, boot, media, and protocol are not available in network cards. Your choice of a network interface card will probably be guided by more-important factors such as the networking software you choose. If they are available, you should install cards that

can use faster PC AT bus interrupts and that carry their own powerful processor for at least the network server.

NETWORK SERVERS The term "network server" designates both a machine and a function. Sometimes the functions of



pendent variable is the network load. We began with the heaviest load, four network workstations running DOS betch files, asking for constant reads of data files from the server. Then we decreased the number of workstations one by one to reduce

The three-dimensional chart above shows the time it took the PC-XT to perform the tests under the varying load on each network. For companson we give the time it took to run the same tests

the network load.

file server, print server, and communications server are distributed among several machines, and sometimes they are concentrated in one server. Software controls the server's functions.

Some networking software programs, notably IBM's PC Local Area Network through the network with no other active eletions

The Network Speed Under Contention test exer-

cises the network when the network interface card and the media era beavily loaded. We attempted to eliminate the factor of server disk access time from this test by loading the network with data blocks small enough to reside in the server's cache meory on most systems. In addition, we varied the size of the files to detect any cache limits

Program and Fox Research's 10-NET, allow any or all stations on the network to contribute and share resources such as disk drives and printers with the network. This approach has some appeal in very small networks, but our experience has been that asking a PC, even a PC AT, to act as both a server and a workstation results in inadequate performance in both roles.

Sharing resources and using stations as both workstations and servers can work well for some applications, but we think that most organizations will quickly outgrow this structure and should plan for a dedicated server.

The file server furnishes file exchange and simultaneous multiple file access to the workstations. It is normally a machine in the 80286 class with one or more large and fast hard disk drives.

The print server, which usually has from one to three printers attached to it. holds and queues files to be printed. Since print spooling works much better if the print server is equipped with a hard disk drive, many networking programs require this capability in the print server. For this reason, the print server is usually the same machine as the file server, but it doesn't have to be

The communications server can be either a bridge to other networks or a gateway to a mainframe or outside communications system. This function often requires a lot of attention from the processor as interrupts are generated during the communications process. If a machine acting as a file and print server is not too heavily loaded, it can probably handle some communications chores. But when the load gets heavy, consider moving the communications function to a dedicated machine with little or no disk storage but with a fast processor.

FILE SERVERS Machines designed to be file servers fall into two categories: multiuse and dedicated. Multiuse systems such as the ITT XTRA XL and AsherNet Server (not previously reviewed) and Texas Instruments' Business-Pro LAN Server were designed to be either a network file server or the host of a multiuser system operating under AT&T's UNIX. They have room for several hard disks, tape backup, and many expansion cards. The AsherNet Server comes complete with its own 500watt uninterruptible power supply and bat-

You could use these systems as standalone computers. Even when they act as network file servers, they are capable of running local applications programs.

13 LANs



Benchmark Tests: 13 LANs

his test simulates heavy access to a detabase manegement system. This is the most This test simulates heavy access to a unique management a year.

general test of network performance we run. The factors that mede networks effective in the other tests elso carried over to this test: Disk-caching software, an efficient media-sharing protocol, and an effective server-to-network interfece made Standard Microsystems Corp.'s ARCnet and both of 3Com Corp.'s networks top performers. The excellent response time of AT&T Information Systems' StarLAN under Novell's NetWare should do away with fears that e system using twisted-pair wiring is too slow for heavy work.

Smart Applications

Performance Times (Times given in seconds)

System Manufacturer	laterface card	Softwere	Server	Zero stations	0ee statioe	Two	Three stelloes	Foor
LeeCourier/Tailgrass Technologies Corp	EtherLink	VINES	LanCourier TG-8000	99 00	115 00	153 00	205 00	239 00
10- NET/Fox Research Inc	10-NET	10-NET	All workstations	81 00	101.00	118 00	164 00	197 00
PCnet/Orchid Technology Inc.	PCnet	Advanced NetWare/86	8-MHz IBM PC AT	50.00	80.00	135.00	168.00	181.00
levisible Network/Invisible Software Inc.	Invisible Network	PC Local Area Network Program	8-MHz IBM PC AT	80.00	110.00	143.00	160.00	175.00
Start AM/AT&T Information Systems	StarLAN	StarLAN Network Program	8-MHz IBM PC AT	79.00	83.00	88.00	95.50	107.50
IBM Token-Ring Network/ISM Corp.	18M Token-Ring	PC Local Area Network Program	8-MHz IBM PC AT	64.00	68.00	71.00	78.00	85.00
G NET Gateway Communications Inc	G/NET	Advanced NetWare 86	8-MHz IBM PC AT	60 07	70 00	73.00	77.00	85 00
ProNET-10/ Proteon Inc.	ProNET-10	Advanced NetWare 286	8-MHz IBM PC AT	46.50	52 50	57 50	67.00	75 00
1816 Takee-Ring Hetwork/ISM Corp.	IBM Token-Ring	Advanced HefWare/286A	8-MHz IBM PC AT	67.00	68.00	69.00	70.00	72.00
Start AM/AT&T Information Systems	StarLAN	Advanced NetWare 286	8-MHz IBM PC AT	51.50	54 50	58 50	63.00	72.00
Business-ProLAN Server/Texas Instruments	EtherLink	Advanced NetWare/E-TI	TI Business-Pro	41.00	47.50	52.00	62.00	65.00
NetWere/S-Net/Novell Inc.	NetWare/S-Net	Advanced NetWare 68	Novell Server 688	61.00	81.00	62.00	63.00	64.00
Ethereet 3Com Corp.	EtherLink Plus	3 + Share	8-MHz IBM PC AT	52.00	54 00	56 00	58 00	59 00
3Com Tekes-Rieg/3Com Corp.	TokenLink Plus	3 + Share	3Server3	56 00	55 00	57.00	58.00	58 00
Ethernet/3Com Corp.	EtherLink	3+Share	3Server3	50.00	51.00	51.00	53.00	53.00
ARCnet/Standard Microsystems Corp.	ARCnet	Advanced NetWare/266	8-MHz IBM PC AT	47.00	49.50	49 50	50.50	50.50

The PC Labs benchmark tests were run u three IBM PCs, one PC-XT, and one PC AT as workstations. The load provided by these stat is heavier and more consistent than that found in normal office or deta processing applications.

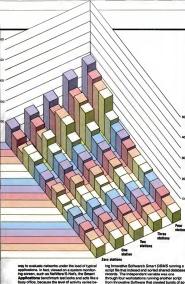
Therefore, the results of these tests can be interpolated to networks with a larger number of workstations but with a more sporadic workload. The default server for these tests is an IBM PC

AT running at 8 MHz. When a network system de pended on e proprietary server, we used that. The IBM PC AT contains only 512K bytes of RAM, and we found that limitation degrades some performance times in comparison with other servers tested with more memory. For the sake of consistency, we tested the network systems, whenever possible, running the appropriate version of Nov-ell's NetWore. We also tested the systems running under eny proprietary or other software from the system's vendor. Timing on these tests was done through the use of a separate clock not on the computer motherboard and therefore not subject to interruption by programs that disable interrupts.

The Smert series of Integrated network pro-grams from Innovative Software gave us a practical

A second class of machines designed to be file servers are those that are dedicated to the job. They have no capability for running local DOS applications. Primary among them are 3Com's 3Server3, Tallgrass Technologies' LanCourier TG-8000, and Novell's Server 68B. The TG-

8000 and Server 68B machines use Motorola's 68000 processor and require unique versions of the network operating system. 3Com's 3Server3 uses an Intel 80186 (a highly integrated and fast version of the 8086). These dedicated servers typically require a separate dedicated terminal or console and are loaded with the networking software either from an internal tape or from a workstation acting temporarily as a remote disk drive. They are treated much more like a minicomputer acting as a host than like a PC.



applications. In fact, viewed on a system monitoring screen, such as Net/Netra-S-Netrit, the Smart Applications benchmark test looks and acts like busy office, because the treet of activity varies between intense use of the network and quiet period when processing taskes place. For the dependent variable plotted on the three-dimensional chart, we used an IBM PC-XT operation.

A general rule about file servers is that they are the bottleneck of the network. The narrowest point in the bottleneck is the server's hard disk. Hard disks move data at speeds from 75K to 100K bits per second. Even the slowest combination of network cards and media has a throughput much faster than that. The fastest processor will not significantly improve the performance of a slow hard disk.

A fact that is becoming more important for servers is that silicon is faster than hardware. 3Com's new 3Server3 uses 2 megabytes of RAM to store large portions of the

hard disk, while it is in use. This method yields exactly the same advantage in speed that individual PC users enjoy when they use a RAMISK. As the size and the price of RAM continue to shrink, we can expect to see more network, servers using megabytes of RAM as buffers for the hard disk—an efficient and effective way to or "labricate" an electromechanical bottle-neck with silicon.

The selection of a server is closely tied to the price you can afford to pay. Machines designed to be dedicated servers can have price tags of over \$8,000, but they give excellent performance in heavily loaded networks.

Lower-priced machines designed along the lines of an IBM PC AT can perform as well on most networks as those expensive machines perform. In fact, some situations would permit you to spit the file server load between two PC AT-type machines and therefore gain redundancy, performance, and network reliability for about the same cost as for one specialized server.

If you need top-end performance in an industrial or developmental system, we recommend that you select a machine designed especially for the server role. But if you have a network in an office doing word processing and administrative support with one or two dozen workstations, then an AT-class machine with the right networking software can serve you well.

One thing that's crucial to a file server is the ability to back up a hard disk on removable media such as a tape or Bernoulli Box cartridge. The method of backup almost doesn't matter, as long as it is accomplished easily enough to be done regularly. If you are using a network in one of

Il you are using a network in one of those critical applications we described earlier, you should also consider an unin-temptible power supply (UPS) for your screer. As these file server systems rely more on large RAM buffers to hold hard disk data, they also increase your vulners of the state of the st

NETWORKING SOFTWARE Before you consider the topology, media, access protocol, or other more arcane issues of PC







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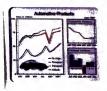




One Program Charts, Symbols diagrams, etc., etc.









Benchmark Tests: 13 LANs

is test moves files between subdirectories on the server's hard disk. It loads the network Interfece cerd in the server end the medie-shering protocols, and it introduces the fector of server disk access speed and efficient I/O handling. The use of write and copy commands minimizes the value of e RAM cache in the server, but megnifies the value of techniques that efficiently move the heeds on the hard disk drive (called "elevator seeking")

Networks using softwere with efficient I/O hendling and servers with fast hard disk drives will perform well in this test. The fast disk drive used in Novell's NetWare/S-Net server gives it outstanding performance. 3Com's 3Server3 has so much memory available for disk caching that it did en outstanding job under every load or task we could provide.

The ective file read, write, and transfer activities of this test ere similar to actions teken during the use of e network for program development. They ere elso similar to the activities of certain types of detebese management applications.

Network plus Server Cruncher

mance Times

System Manufacturer	Interface card	Softwers	Server	Zero stations	One station	Two stations	Three	Four sistions
18-NET/Fox Research Corp.	10-NET	10-MET	All workstations	82.44	122.59	200.01	274.18	364 24
PCnet Orchid Technology Inc.	PCnet	Advanced NefWare 86	8-MHz IBM PC AT	67 50	140 61	241.22	308.51	356 52
StarLAN/AT&T Information Systems	StarLAN	StarLAN Network Program	8-MHz IBM PC AT	105.49	154.56	196.80	253.48	305.33
Ethernet/3Com Corp	EtherLink Plus	3 + Share	8-MH2 IBM PC AT	51.00	112.00	154.00	191.00	252.00
Invisible Hetwork/Invisible Software Inc.	Invisible Network	PC Local Area Network Program	8-MHz IBM PC AT	75.00	109.00	129.00	187.00	237.00
IBM Token-Ring Hetwork/IBM Corp.	IBM Token-Ring	PC Local Area Network Program	8-MHz IBM PC AT	63.68	68.00	130.05	171.48	216.11
ProNET-10 Proteon Inc.	ProNET-10	Advanced NetWare/288	8-MHz IBM PC AT	58.96	82.50	125 12	143.37	200 30
LenCourier Taltgrass Technologies Corp	EtherLink	VINES	LanCouner TG-8000	38 61	55 46	70 63	132 37	192 67
IBM Tokes-Ring Network/ISM Corp.	IBM Token-Ring	Advanced NetWare/266A	8-MH2 IBM PC AT	55.83	95.68	131.18	147.97	177.52
StarLAN/AT&T Information Systems	StarLAN	Advanced NetWare 286	8-MHz IBM PC AT	58.41	80 47	112.00	131.26	158.65
6-NET/Gateway Communications Inc.	G/NET	Advanced NetWare/86	8-MHz IBM PC AT	54.85	81.02	98.02	122.31	145.77
3Com Token-Ring/3Com Corp.	TokenLink Plus	3+Share	3Server3	52.00	69.00	88.00	109.00	142.00
ARCnet Standard Microsystems Corp.	ARCnet	Advanced NetWare 286	8-MHz IBM PC AT	59.45	85.85	73.87	110.65	128 63
Ethernet/3Com Corp	EtherLink	3+Share	3Server3	44 00	63 00	79 00	98 00	112 00
Business-Pro LAN Server/Texas instruments	EtherLink	Advanced NetWare/E-TI	Ti Business-Pro	41.11	54.43	82,63	93.47	104.85
NetWere/8-Net/Novell Inc.	NetWare/S-Net	Advanced NetWare 68	Noveli Server 68B	71.00	73.05	79.45	86.87	91.00

The PC Labs benchmark tests were run using three IBM PCs, one PC-XT, and one PC AT as workstations. The load provided by these stations is heavier and more consistent than that found in mal office or data processing applications. Therefore, the results of these tests can be inte lated to networks with e larger number of workstations but with a more sporadic workload

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from the system's vendor. Timing on these tests was done through the use of e separate clock not on the computer motheradministrator. The networking software is the tool the network administrator uses evboard and therefore not subject to interruption by

programs that disable interrupts. For the Network plue Server Cruncher bench-

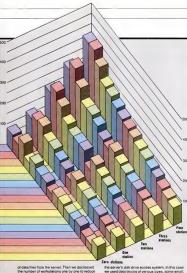
mark tests, the dependent variable is the time it took for the IBM PC-XT on a LAN to perform a standard set of DOS read-write commands again e single data file residing in the server. The independent variable is the network load. We begen with the heaviest load, four network workstations running DOS batch files, asking for constant reads

LAN selection, you should tentatively choose the networking software you want to use.

Like the media and the access protocol a LAN uses, the networking software is

ery day to satisfy the needs of the network users. As with any good tool, it must be manageable, flexible, and strong, largely invisible to the users of the net-In our evaluations we found that the work, but it is very visible to the network best networking software packages are

very similar in performance and features. The internal architectural differences, though, among Banyan Systems' VINES, Novell's NetWare, 3Com's 3+Share, IBM's PC Local Area Network Program, AT&T's StarLAN and Network Program. and Fox Research's 10-NET are signifi-



 One element of LAN software that sounds like a good idea but has only limited use is the menu.

did experience a problem with the automatic installation procedure on an 8-MHz IBM PC AT.)

The difficulty of system setup varies with the number of utilities you install and features you implement. On a feature-byfeature basis, we found Fox Research's 10-NET the easiest networking software to set up. Its method of creating a profile file holding each individual's identification, permissions, and other factors is easy to understand and follow. In contrast, installing the 3Com's 3+Share software always seemed to be complex and not completely intuitive, even though we did it at least six times over the course of our work. Novell's NetWare falls in between 10-NET and 3+Share; it appears complex, but it isn't once you discover that it involves a number of nice but not entirely necessary media tests. Its setup process takes some time but requires organization more than difficult labor. One element of LAN software that

One element of LAN software that sounds like a good idea but really has only limited use is the menu. Menus seem to be important only to the network administrator, who sets up LAN systems for all users through the use of batch files that he creates. He can make temporary assignments and changes as quickly and simply as entering DOS commands.

Network performance depends greatly on the size and the number of buffers, the allocation of a server between dedicated network and shared local operation, and the arrangement of applications programs. So tuning a network for best performance, a little-understood part of setup and maintenance, is very important.

In particular, IBM's PC LAN and 3Com's 3+Share can benefit from tuning for peak performance. Advanced NetWare has a good set of default parameters that

the number of workstellons one by one to reduce the network load. The three-dimensional chert above shows the

time it took the PC-XT to perform the tests under the varying network load on each network. For companson, we give the time it took to run the same tests through the network with no other active stations (Zero stations).

The Network plus Server Cruncher test heavily loads the network interface cards, the media, end

cant. Yet after these programs are installed, these differences come down to what we normally would call features: menus and accessory programs such as mail, chat, and network reporting.

If you differentiate between installation (getting the files installed and in the right place) and setup (getting the LAN ready for users), none of the networking software programs we reviewed were particularly difficult to install. IBM's PC LAV was probably the easiest of all; you simply boot a disk, make one keystroke, and follow the screen directions. (However, we

some large, when we loaded the network in ord-

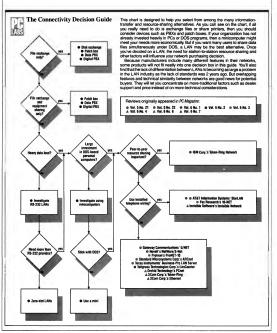
results are influenced by hard disk performance

and the efficiency of the networking softwere as it

moves date on the disk and between the disk end

the network interface cards

to exercise the hard disk drive access system. The



Think You Need an AT?

Think Again.

TABLE OF BENCHMARK RESULTS

This abbetones the results of the from P.C. Magazine, or via the P.C. Norton System Information Text, is processoriory processoriory resource prede destuw. Magazine Publish board. These not not m.C. Magazine but is part of ing the April 1986 release of P.C. results were obtained by us an P.C.S., the popular "Norton Utilities." The Resizine F.C. Eabs Benchmark. and are not yet official published P.C. Section views dws al.; a which is the Text of the P.C. Norton State of the P.C. Norton State of P.C. Text of the P.C. Norton State of P.C. Text of the P.C. Norton State of P.C. Text of P.

	IBM PC	IBM AT	BREAKT	HRU 286
Clock speed in MHz (IBM PC is 4.77)	4.77	6	8	12
Empty Loop	1	1.99	3.34	5.15
Integer add from memory	1	3.35	4.41	6.02
Integer multiply from memory	1	6.06	6.55	8.3 5.76
Floating point without coprocessor	1	3.33	4.42	5.76
Prime number test	1	1.95	2.85	3.7
Lotus 123 macro (640K)	1	2.64	3.69	4.62
Lotus 123 macro (256K)	1	1.77	3.54	4.38
Norton System Information Test	1	5.73	7.34	10.2

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"Lightning is almost mandatory... It has been utterly trouble free in the

year I have used it." - Steve Manes, PC Magazine Best of 86 review. Loads with the DOS - always ready as a background program to accelerate disk access. You do not

LIGHT/NING does what a speedup board cant. You are going to be so amazed when you start to work with LIGHT/NING installed. Most programs that frequently access the disk frant disk or floopy) like databases or word

e instantly faster up to 2 to 4 times faster. LIGHTINING enables any program to approach the same rapid speed as a RAM Disk, but it does it without the RAM Disk danger of losing precious data if you lorget to save it. It works by a principle borrowed (and greatly enhanced) from main frame technology called caching. But it doesn't speed up the microprocessor. You need a speedup board to LIGHTINING is the standard against which all our competition measures itself because we achieve universal

compatibility with other software and with complete reliability Data is never lost. LIGHTINING fully exploits Above

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Second, it is advanced. The BREAKTHRU 286 replaces the CPU of the PC or XT with an 80286 microprocessor that is faster than the one found in the AT. You have your choice of 8MHz at \$395 or 12 MHz at \$595. You can plug in an optional 80287 math coprocessor chip

for numeric intensive applications. A 16K cache memory provides zerowait-access to the most recently used code and data. Look at the benchmark tests box to see how our two

never want to go back to slow again. Third, you have full compatibility. All existing system RAM, hardware, and peripheral cards can be used without software modification. Our boards operate with LAN and mainframe communication products and conform to the Lotus/Intel/Microsoft Expanded Memory Specification (EMS). Soft-

ware compatibility is virtually

boards compare with the PC and

the AT. Speed is addictive. You'll

universal. Fourth, these are the best. There are several other boards on the market. We at PCSG have compared them all, but there simply is no comparison. What we discovered is that many cards being sold offer only a marginal speedup in spite of their claims and others are just poorly engineered. For example some boards have a cumbersome mechanical switch for going back to 8088 speed, but the Breakthru boards have speed switching soft-

ware that allows you to drop back to a lower speed on the fly for timing sensitive applications. The 8MHz BREAKTHRU 286 and the 12MHz are unequivocally the best executed and most completely reliable

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SOFTWARE
Novell's Advanced NetWare/286, Version 2.0a
SYSTEMS

 Standard Microsystems' ARCnet running under Advanced Net-Ware/286 on the 8-MHz IBM PC AT server

 3Com Corp.'s Ethernet running under 3+Share on the 3Server3

Advanced NetWare/286 excels in the area of disk management. NetWare's directory-hashing technique indexes entries according to a mathematical formula for fastest retrieval. NetWare's "elevatorseeking" and disk-caching features further optimize disk server performance. In addition. NetWare allows users to use up to four different brands of network cards in one server. NetWare's security is also outstanding. Under NetWare, the ability to read, write, create, delete search, and modify files are all separate functions that can be allowed or denied to individual users

Standard Microsystems' AFCnee is easy to install resists degradation under heavy loads, and ensures successful data romanisation by checking and revor-checking and revansumssion protocol. Other LAN vendors that understand the technology and look for reliable performance repackage AFCnet boards with their systems. For example, Novell uses AFCnet Soards to extend its NeW week. Net systems.

3Com's Ethernet running under 3+Share with the 3Server3 has the performance and feature sto match the previously unchallenged Net-Warel ARCnet team, plus it has the added flexibility of the standardized Ethernet interface. This interface opens an even wider world of interconnection canabilities to users. provide excellent performance out of the box, but you can also easily tune it. IO-NET is particularly rigid and could significantly benefit from the use of more buffers and disk cache.

and another difference between networking offware programs is in communications functions. 3Com and Novell provide good communications functions. 3Com and Novell provide good communications capabilities in their product lines, but Banyan's VIMES (also markeded say not Tallgrass's LanCourier system) stands out from the other products we reviewed in its ability to handle communications tasks. If your network requirements are heavily weighted toward modern sharing, network bridging, and communications gate way exity V, VMZS and the communications gate way exity V, VMZS and for chiling to the product of the communications and the vibility.

SECURITY While all the products we cramined had good password protection schemes, we feel that if security is an important factor to you, Novell's NerWare should be high on your list for consideration. NerWare provides an array of permissions and limitations. It also protects the server's hard disk from access from the server's heard of the product of the product

A special version of NetWare, System Foult Tolerant (SFF) NetWare, enhances the reliability of some critical components on a network, SFF NetWare has redundant directories and special verification process during the network of the network.

One area of networking software that begs for improvement is network trouble-shooting and reporting. Administrators need good took to see who is using the network, how it is being used, and what transmission problems are being encountered. For Research's 10-MET and Banyan 5 from the second of th

vendor to develop a product that offers these tools.

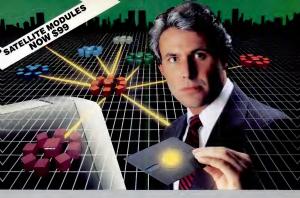
nnes toos.

One difference between the networking software preduces that may be important to go the produces that may be important to go the produce that the produces that the produces are the produces and SCom's 3+5hare steal Renwork Program, and SCom's 3+5hare steal Renwork in one being used at the moment. This softwire could infinite the ability of working to the produces that the produces that the produces that the produces that use a lot of RAM—large spread-sheets, for example.

Some other brief observations about motwring software. Novell's on-score nutorial (done with Software Recording CV, AutoMonto) is excellent. For Research has an audicuape and 55mm side control of the search has an audicuape and 55mm side of the search has an audicuape and 55mm side of the network in many organizations. Advanced NeWare 286 works very well with a S-MHz Pc AT that is nominally limited and S-MHz and S-MHz is some of the store of the search of the

We expected to be able to measure significant differences in the amount of siminificant differences in the amount of siminificant differences in the amount of the networking software package versus another, but we were not able to find them. We concluded that a well-trained and knowledgeable network administrator will knowledgeable network administrator will untaintaining the software for a network of 12 to 24 stations—a smaller workload than we had anticipated. An untrained or inexperienced person, on the other hand, can spend week in trial-and-error learning.

NETBIOS NETBIOS is an interface program, originally developed by IBM and Syste, that works between the network adapter hardware and the networking software. Some communications software to the communications programs such as DCA's IBMALAN use NETBIOS to setablish communications work hardware manufactures (such as first work hardware work hardware). When the such work hardware work hardware Almost all companies have as-hardware. Almost all companies have as-



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LAN SELECTION CRITERIA

If you're still hazy about which LAN would best serve your needs, the following guidelines will help you match the right LAN with different environments.

To help you select the type of network that is right for your needs, we have been giving you a Connectivity Decision Guide with our reviews that presents the various issues to consider.

But after you've worked through the matrix we published originally, how do you choose from the 13 local area networks we evaluated and the other offerings in the marketplace? Let's look at some other important factors you can use to guide you as you go further down the LAN decision tree.

PREMIUM FOR RELIABILITY? An early LAN selection decision you'll want to make is how much of a premium you're willing to pay for redundancy and reliability.

Assure that the uses of a local area network can be divided into two catagories critical and normal. A network falls into the critical sea energy if you use if for process control during manufacturing, security, medical applications, on line service, or other applications that have an immediate impact on the opperation of the organization. The normal category includes all the other networks, those used for administrative support, accounting, and finitenos that wort immediately affect health, safety, or the bottom line if the network fails.

If your application falls into the critical category, we suggest that you consider networks that use the token-passing protocol and the hub physical topology. Examples of such networks include IBM Corp. 5 Token-Ring Network, Standard Microsystems Corp. 5 ARCnet, Proteon 5 ProNET-4 and ProNET-10, and (in a slightly different physical topology) 3 Com Corp. 5 Token-Ring.

If you require network reliability, Proteon has systems that offer significantly improved media reliability through the use of redundant cabling. Novell offers a special version of NetWare that can operate hard disk drives and/or complete servers in a shadow mode, so that if one system faults, the

other can pick up without dropping a bit.
If your application is in the normal
rather than the critical category, you
don't need to pay the added cost of the
wiring hub, which can vary widely in specific installations but at a minimum
costs an estimated \$100 per workstation
more than a station-to-station configuration. This estimate could increase by a
magnitude of 10 in some installations.

For normal network reliability, a less expensive system using a station-to-station wiring scheme and the CSMA (carrier sense multiple access) protocol can satisfy your requirements. The products of many companies, ranging from 30cm's fast Ethernet to Fox Research's slower but less expensive 10-NET, meet these criteria.

SECURITY The next major criterion you should consider is how to meet your need for business-level security to keep documents private, accounts safe, and data free from harm. The need for enhanced security should influence your choice of networking software as well as the physical topology and the media of the network.

A LAN's networking software is the basic element in its security program. The software recognizes the name of a user, confirms identity with a password, and allows that user to perform specific functions on certain information based on a profile established by the network administrator. Certain programs have more-elaborate lists of functions than others.

If you have data moving across your network that would interest industrial



spies, you should make some effort to protect it. People with equipment that can gain access to the media of your network can easily capture and read all the information the LAN transmits. The media should traverse only those areas under positive control.

Fiber-optic cable is much more difficult, if not impossible, to tap than coaxial cable. Fox Research and Proteon market systems that use fiber-optic cable, and several companies market fiber-optic adapters that can replace coaxial cable in areas of higher risk.

Other physical security factors involve access to the server and its files. People intent on snooping or destroying files should not be able to access the server's hard disk from the server's console.



If you choose DOS-based software such as 3Com's 3+Subar or BM's PC Local Area Network Program, plan on providing physical security for the server. Noted the Area Menor and Banyan Systems' VINES do not allow a person with access to the server's keyboard to manipulate the files on the server's hard disk that are shared with the network.

NETWORK LOAD The amount of network workload and the nature of that load, which are especially important in your choice of a network, are factors that are difficult to quantify. The amount of the load mainly influences your selection of a network server. But the nature of the load is a consideration in your selection of the access protocol. Since the network server can limit the network's performance significantly, it must be properly selected and the work-load properly divided. As a rule of humb, plan for one high-quality file server (80286- or 68000-based) for every 24 active workstations. If your workstations have their own internal hard disk and use the server only infrequently or specific applications, the network can serve many more stations.

The nature of the workload can influence your choice of access protocol. If network workstations exchange many long files, you should consider a token-passing protocol so that all stations get an equal chance at the network. If the load is made up of many short transmissions, the CSMA protocol might serve you better than the token-passing protocol, but the difference will be slight.

MULTIVENDOR STATIONS Another factor that may affect your selection is the presence of stations on the network that don't use the IBM PC bus or operating system. A local area network can carry much more than PC-to-PC communications and DOS file access.

If you need to interconnect computers and terminals with very different architectures, consider the ProNET-10 and Ethernet networks. Proteon markets. Proteon markets. Proteon markets. Proteon markets produced in the properties of the properties of the properties. Many companies, including IBM, sell ports or market adapters for Ethernet networks. 3 Com's Etherlink cards in a PC can communicate (at least at a primitive level) with network of kadpers made by other companies in an Ethernet network.

EXISTING WIRING Finally, existing cable or wire can influence your choice of network. If properly twisted and installed telephone wiring that goes to the right places is available, AT&T Information Systems StarLAN or Fox Research's 10-NET might be an economical choice. If RG-62 or similar cable from an IBM 3270 installation is available, you could reuse it for certain coavailable, you could reuse it for certain coavailable.

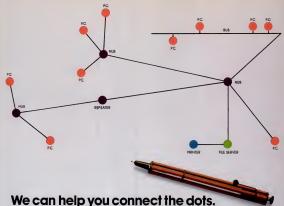
WHOM DO YOU TRUST? After you work through the technical factors of LAN selection, consider the important managerial element. You need help when you're installing and maintaining a large local area network with many features, and we strongly suggest that one of the most important factors you should evaluate is the support you can expect from the LAN manufacturer and dealer.

If you want a turnkey installation (often worth the price), you should be able to trust the dealer. If you want to do your own installation and don't want to buy a maintenance contract, you'll need to be able to rely on telephone support from the manufacturer.

■ If you have data that would interest industrial spies, you should make an effort to protect it.

While we did not attempt to evaluate the technical support available from all the vendors whose products we saw, we can state from our experience that Xorm. Novell, Cateway Communications, and Fox Research have excellent telephone-support services. To jivizili, here services are busy; you generally have to leave a message and waif for a return call. Often the support statish will answer question to the services are busy; one generally have to leave a message and waif for a return call. Often the support salts will answer question to the services are busy opened a service account, but the exchinicians we talked to at these companies were both well informed and heleful.

MORE HELP PC Magazine's new column. Connectivity Clinic, is designed to supply solutions to common and un-common problems in all types of information transfer systems. Send your questions to Connectivity Clinic, PC Magazine, P.O. Box 691, Herndon, VA 22070.—Frank J. Derfler, Jr.



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knowledged that NETBIOS has a place in their product plans.

One of the products we reviewed, Fox Research's 10-M2T, is not NETBIOS apable, as we went to press. The company able, as we went to press. The company apable, as we went to press. The company for the products in Europe, but they have not been released. If you want to use Fox Research's software products only on Fox Research's network interface cache, when the products won't care about NETBIOS capability. If, however, you want to introduce new buildings of the buildings of the products of the products of the products of such as IRMALAV), NETBIOS is immortant to you.

Our bottom line on networking software selection? From what we have seen, if you want flexibility in network card and media selection, we advise that you stick with NetWare, 3 *Share, or VIWES. Making a choice based on the differences between them comes down to selecting the features you need. If you want al or of eapability at a good price, you'll want to consider ID-NET.

LESSONS LEARNED There you have it: our observations based on months of work and what we estimate to have been over 75 separate network installations. (We installed many networks three or four times because of hardware, personnel, testing, shipping, and operational reasons.)

Our experience shows us that the PC LAN industry has mature products that are reliable and easy to use and can be installed with reasonable care. Selecting one of these products for your own particular needs is now up to you—with some additional help from us in the accompanying sidebar, "LAN Selection Criteria." Fig. 1975.

Frank J. Derfler, Jr., is a contributing editor of PC Magazine.

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Ouce a stratospheric speed rating, 10 MHz is becoming the minimum standard operating speed for AT-compatible computers. Here's a look at the first rush

of racy products at this performance level.

en MHz sounds like a compelling figure: a nice, round number with its own kind of perfection in a world that prefers decimal notation. As a computer operating speed, however, 10 MHz at first appears to be little more than an orphan number, faster than the base level of compatibility but not fast enough to claim the status of ultrahigh performance.

In the face of the lower- and higher-performance competition, justifying a choice of a 10-MHz clock speed for an AT compatible seems difficult. The speed standard set by almighty IBM is currently 8 MHz. and when you break through its bonds in search of speed, the sky's the limit: 12- and 16-MHz AT compatibles and the first generation of 80386 machines typically running at 16 MHz. For a look at reviews of four 12- and 16-MHz machines, see "High-Speed ATs: Life in the Fast Lane" in the previous issue (PC Magazine, Volume 6 Number 7).

Soon, however, 10-MHz operation may need no justification. It may become

the minimum level of performance to be expected from any AT compatible. Given a few more months and the fierce competition in the personal computer marketplace, 8 MHz may become the orphan speed, as 6 MHz has now become.

Already the only people who are not candidates to buy a 10-MHz AT compatible are those who are firmly committed to IBM beyond all hope of reprieve. As this is written. IBM seems to be the lone company reluctant to tread past the 8-MHz speed barrier. The seven new machines reviewed here and two we've looked at before all deign to dip to slower speeds, if at all, only for that rare, irascible software that resorts to system timing loops to befuddle you with copy protection. For these computers, 8 MHz-or worse, a super-compatible 6-is a degradation rather than an operating speed.

The higher base speed exacts no other penalties, not even from your wallet. All seven of these systems are less expensive than any official IBM computer with an

10-MHz COMPUTERS

80286 microprocessor—even the latest BIM PC-XT Model 286, which drags along at a laggardly 6 MHz. The least expensive of the systems investigated here, from Computer Direct, costs little more than half of what the cheapes 8-MHz machines sold for just a year ago. That company, among others, doesn't even offer a slower for cheaper PC-AT.

Power users may look down their noses at a mere 10 MHz when faster PCs are readily available. But PC ATs running at 12 MHz and higher still command a premium price. Some of them also suffer from hardware incompatibilities. Venture more than 10 MHz up the speed spectrum and signals, as well as components, become

quirty and expensive. For instance, 10-MHz is about the upper limit that you (with uck) might squeeze out of an IBM PC AT sans its ROM-based speed governor. Twelve MHz is definitely over the line. Memory and support chips rated to run at 10 MHz are commonplace; faster varieties are exotic, more expensive, and sometimes only experimental (even though they may be used in some supposedly production machines).

PERILS OF SPEED Many ordinary add-on expansion boards won't work when speeds shoot past the 10-MHz boundary. Even high-performance disk controllers can tailspin into trouble. You

can never be absolutely sure that a particular internal peripheral will work in a superperformance computer (unless, of course, the maker of the board guarantees that it will). Worse, a marginal component can fail at any time—usually just before you make that all-important save—and send your system and your sanity crashing.

Because the 12- and 16-MHz machines are sailing somewhat uncharted waters, rather than single out any of the four machines reviewed last issue as an Edition's Choice, we recommended "Proceed with Caution." That's not the case with the 10-MHz machines reviewed here: the AST Premium/286, CD/286, Kaypro 2861, PC's Limited 26-01, and Protess Technology.

10-MHz Computers: Summary of Features

	CD/286 Computer Oirect	Proteue Technology 286 Stenderd Proteus Technology Corp.	ALR PC2E/10 MHz Advanced Logic Research Inc.	PC Designe ET-2881 PC Designs Inc.	
Base price	\$1,695	\$2,195	\$2,995	\$2,400	
BASE PRICE INCLUDES					
RAM Floppy disk drives Hard disk drives	512K One 1.2-Mbyte None	1 Mbyte One 1.2-Mbyte, one 360% None	1 Mbyte One 1.2-Mbyte 20-Mbyte	1 Mybte One 1.2-Mbyte None	
Clock/calendar Ports Slots	None 8	3 serial, 2 parallel 8	1 serial 5	3 serial, 2 parallel 6	
Power supply (watts) Reset key Keyboard style	192 Original	200 • Original	130 Original	192 • Original	
CONFIGURATION TESTED					
Price Includes	\$2,189 20-Mbyte hard disk, monochrome monitor	\$2,584 30-Mbyte hard disk	\$2,995 20-Mbyte hard disk, monochrome monitor	\$3,145 30-Mbyte hard disk	
SPECIFICATIONS					
Clock speed (MHz) Controller card handles	6, 10 2 hard, 2 floppy disk grives	6, 8, 10 2 hard, 2 floppy disk drives	10 2 hard, 2 fleppy disk drives	8, 8, 10 2 hard, 2 floppy disk drives	
MISCELLANEOUS					
Werranty	1 year	15-month warranty, free 2 months on-site ser- vice, 30-day money-back guarantee	1 year	1 year	
BIOS manufacturer	1986 DCC	Proteus	Phoenix Software	ATI	
Indicates Editor's Choice	Yes O-Ne				

nology 286 Standard and four reviewed earlier and recapped here, the ALR PCZE/10 MHz, the Epson Equity III Plus, the Multitech Accel 900, and the PC Designs ET-286i (see sidebar "More 10-MHz Machines: Completing the Picture").

At 10 MHz, most add-on hardware operates perfectly. The only common hardware board that would not operate in any of these 10-MHz compatibles during PC Labs testing was an IBM Asynchronous Communications Adapter, which IBM lists as incompatible with the ordinary 6-MHz AT.

Note that some high-performance AT compatibles, including the Compaq Desk-

Many ordinary add-on expansion boards won't work when speeds shoot past the 10-MHz boundary.

pro 386, avoid speed incompatibilities with hardware by operating their expansion buses at a lower speed than the adver-

tised ratings at which part of their memory may operate. Slowing down a system for any reason steals some of the luster from the high-performance promise and makes a mere 10-MHz computer more competitive than you would think at first.

AT compatibles that are both faster and account han 10 MHz are likely to be available for a long time to come. But as these may be company name) ably demonstrate, you need not settle for less—and you may not want to pay more. Also note that the list prices for the mail-order machines are the prices you! If pay, while machines available through dealers (AST, Epson, Kay-pro) can be had at a discount.

	Accel 900 Multitach Electronics Inc.	PC'a Limited 288-19 PC's Limited	AST Pramium/286 AST Research Inc.	Epson Equity III Plus Epson America Inc.	Kaypro 2881 Kaypro Corp.
Base price	\$2,395	\$2,295	\$1,995	\$2,695	\$1,995
BASE PRICE INCLUDES		1		1	
RAM Floppy diek drives Herd diek drivee	512K One 1.2-Mbyte None	1 Mbyte One 1.2-Mbyte None	512K One 1.2-Mbyte None	640K One 1.2-Mbyte None	640K Ona 1.2-Mbyte None
Clock/calendar Ports Stote	e 2 serial, 2 parallei 8	None 8	1 serial, 1 parellal	1 serial, 1 parallel	Mone 8
Power supply (welts) Resel key Keyboard style	200 • Original	220 O Original	200 Enhanced	200 Enhanced	185 O Original
CONFIGURATION TESTED					
Price Includee	\$3,295 30-Mbyta hard disk	\$3,383 40-Mbyta hard disk, EGAds! board	\$3,495 40-Mbyte hard disk, EGA monitor and card	\$3,895 40-Mbyte hard disk	\$3,995 Model C with 30-Mbyta hard dlak, EGA monitor and card, extra ports
SPECIFICATIONS					
Clock epeed (MHz) Controller card hendles	6, 10 2 hard, 2 floppy disk drives	6, 10 2 hard, 2 lloppy disk drives	6, 8, 10 2 hard, 2 floppy disk drives	6, 8, 10 2 hard, 2 lloppy disk drivea	10 2 hard, 2 floppy disk drives
MISCELLANEOUS					
Werranty	1 year	1 year warranty, 30-day money-back guarantee	1 year	1 year	1 year
BIOS menufecturer	Award Software	PC's Limitad/AMI	Phoenix Software	1986 Selko Epson Corp	Kaypro

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8 MHz 80286	12 MHz 80286	16 MHz 80386
BK Coche	1 or 2 M8 EMS	64 K Coxhe
	PC, XT	286 286e-12 PC_XT PC_XT_AT 3 x XT 8 x XT Replaces Caprocessor 8 MHz 12 MHz 80786 80786 R6 Lor 2 MR

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Orchid's accelerator cards give you the best compatibility in the industry. So you protect your existing investment, and extend your computer's

useful life. While avoiding the headaches of learning a new system - not. to mention the cost of burning one.

GET THE EDITOR'S CHOICE: TinyTurbo 286.

Shift into high gear. Get a great card at a great price - the crowdpleasing TinvIurbo 286. It supercharges your XT to run three times faster than before. Yet it's so small it takes up only half a slot in your computer. Just two reasons why PC Magazine named it the Editor's Choice.

TinvTurbo 286 gives you a high level of compatibility that lets you run software like Lotus and Windows at AT speed with EGA graphics, EMS memory or networking cards. You can even go back to your PC's regular 8088 chip, which remains in the system, giving you 100% hardware compatibility.

ADD AWESOME PERFORMANCE: PCturbo 286e.

The front runner today in the accelerator stock card race for power users is clearly the PCturbo 286e: It revs up to 8 times faster than an XT or up to 2.5 times AT speed. Giving you - among other things - the world's fastest screen I/O. Plus the PCturbo 286e comes factory equipped with I Megabyte of fast RAM. expandable to 2. PCturbo 286e is a powerful tool

for developers and systems integrators. Through its advanced design, it lets you build minicomputer-like performance into standard PCs. With features like an optional 10-MHz 80287 math chip, and coprocessing software for concurrent foreground/ background tasks.

MOVE YOUR AT UP TO 386 HORSEPOWER NOW: Jet 386.

Take a look today at the price/ performance leader in desktop computing: the Jet 386. Depending on the application, it's up to three times faster than an AT. And twice as fast as some high-performance minicomputers. Yet you don't have to buy an expensive 386-based computer to get this kind of horsepower.

More importantly, Jet 386 uses the next generation technology, the 80386 microprocessor. So you can run all of the current software for the AT now, and all the new 386 software. By adding a Jet 386 to your AT today. you can extend the life of your investment well into the future. For a fraction of the cost.



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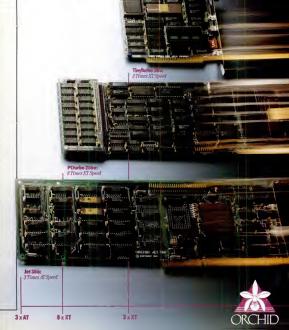
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AST RESEARCH INC.

AST Premium/286

The IBM PC AT had a devastating effect on the expansion board industry because all the traditional PC hardware add-ons were built in. Companies specializing in add-on accessories adopted various strategies to cope, the most successful of which was diversification. One result is the AST Premium/286, a product of the renowned memory board maker, AST Research.

The Premium/286 lives up to its name and looks its part. The stylist responsible for it should take credit for the most elegant variation on the basic AT chassis. The white-beige plastic front bezel is cut by a wide swath of darker gray-beige that unifies the square, indicator/control panel on the left with the disk drive bay on the right. Both the AST monitor (an EGA display with the evaluation unit) and the keyboard are styled to match. The machine should complement any office, including the CEO's.

Pull the lid forward and off, and things look even better. Workmanship is clearly top-notch.

The system is designed around the Chips and Technologies VLSI CHIPSet, and compatibility is assured with a BIOS

written by Phoenix Software. Run PC Labs benchmark tests, and the Premium/286 is even more impressive. The starting combination is good: an 80286 microprocessor running at 10 MHz with an extra socket for an optional 80287

numeric coprocessor. The telling difference is the unusual memory arrangement of the Premium/286

that permits no-wait-state RAM access without the sacrifice of compatibility. At best, the system can retrieve bytes from RAM 43 percent faster than an 8-MHz PC AT can

The system clock speed can be reduced to either 8 or 6 MHz by pressing a combination of keys. A front-panel indicator shows your choice-the system gives no other confirmation (such as a beep or onscreen message) that its speed has been changed. A keylock and a hardware reset switch also decorate the front panel.

No RAM is installed on the system board. Every byte is relegated to a special memory expansion card. The card is unusual in that it has three connectors: two

for the standard AT 16-bit bus, plus an extra one at the opposite end of the board that allows the microprocessor to get at the RAM without going through the waste of time involved with normal bus control circuitry. The normal 16-bit bus remains completely AT compatible and allows the use of ordinary memory boards with one

wait state. One bank of 18 100-nanosecond 256Kbit DRAM (dynamic RAM) chips is soldered to the memory board, yielding a total of 512K bytes of memory. Three additional banks of sockets are available for adding extra chips in half-megabyte blocks. The evaluation unit had one of these banks filled.

The elegant look of the Premium/286 is subtly accented by the slightly reduced width of the chassis-it's about 2 inches narrower than the IBM PC AT at 61/2 by 191/4 by 161/2 inches (HWD). The inches were pared from the expansion board area. leaving room for only seven slots. Two use the 8-bit PC-XT bus, and the remaining five match the 16-bit PC AT bus, with two of the latter also having zero-wait-state connectors.

slot is filled with a display adapter, one 16bit slot is filled with a Western Digital WD1003-style combined floppy/hard disk controller, and one zero-wait-state slot is equipped with the proprietary memory board.

NO SPACE WASTED No drive space was sacrificed to the chassis slim-down. Both a full-height internal disk drive bay and a right-hand bay that allows front-panel access to three half-height devices are supplied. Disk drives are mounted without rails by screwing them directly into place. But because a solid chassis panel covers the front of the internal disk drive bay, hard disks installed there must be lowered into place.

A high-density, 51/4-inch, 1.2-megabyte floppy disk comes as standard equipment in the top of the right-hand bay. The Premium/286 we evaluated came equipped with a high-performance 40megabyte Micropolis hard disk in the internal bay. Models equipped with 60- or 70-megabyte hard disks are also available. A 200-watt Astec power supply fills the right rear comer of the chassis.





HOW TO RUN A HARD DISK SYSTEM WITHOUT BACKUP.

Crossing your fingers is great when you're telling your mother-in-law you'd love to have her visit for a month. But, you are pressing your luck when you run your computer system without backup protection.

Crossed fingers won't help when a crash wipes out your data and you have to spend hour after hour trying to retrieve what has been lost, recreate what has been

forgotten or re-enter what is gone. But, a Cipher 5400 tape backup system can offer dependable security for that important data. Designed for today's high capacity disks systems on the IBM PC XT, AT and compatibles, the Cipher 5400 is available as shaking hands after a successful deal.

So, why not uncross your fingers and use one to dial 1-800-843-375, Ext. 9; or within California, 1-800-722-0670, Ext. 9; for more information about the Cipher 5400 backup system.

Cipi

■ 10-MHz COMPUTERS



into the system board. The parallel port uses an IBM standard female DB-25 connector. The serial port uses a PC-XT-style male DB-25. A lithium battery pack, attached to the power supply with Velcro, powers the built-in clock and CMOS (complementary metal oxide semiconductor) configuration memory.

ory arrangement

CIRCLE 604 ON READER SERVICE CAR

System setup is accomplished as with the IBM PC AT, using a special program on the AST diagnostic disk.

Accompanying the Premium/286 is a small shelf full of documentation, four IBM-sized binders filled with manuals covering MS-DOS 3.1, BSACI, system operation, utilities, and options. The books are clearly written and are suitable for a newcorner to compuing. They lack attention to echnical details, however, and give the most-experienced user little guidance as to the inner workings and intricacies of the machine.

One of the utilities supplied by AST is an expanded memory manager to make the bytes beyond DOS's 640K usable by programs written for the Lous/Intel/Microsoft expanded memory specification. This driver slows down the system, however. In PC Labs testing, the memory manager retarded RAM access by about 2D percent, though still leaving it faster than that of most 10-MHz AT commatibles.

The keyboard supplied with the Premium/286 closely matches the IBM enhanced keyboard in every way but feel. Among its 101 keys are 12 top-row function keys, a separate cursor keypad, and a number of relocated and duplicated keys (such as Ctrl and Alt). The touch of each keypress is very good—springy with a positive over-center feel—but lacks audible feedback.

An AST EGA display was supplied with the Premium286 we valuated. This 13-inch monitor comes complete with a littlewivel podestal, has a near-black background, and is antiglare treated. Images are sharp and bright, in every way equivalent to the matching IBM display, except that the monitor was decidedly unhappy about switching into 40-column display mode.

Overall, the AST Premium/286 rates as what may be the best-designed and built AT compatible on the market today. Others come only faster, not better.

COMPUTER DIRECT

Computer Direct is a relatively new mailorder supplier of very low cost PC products, of which the CD/286 is the least-expensive AT compatible. Despite its 10-MHz, one-wait-state speed rating, the compatibles currently available. Its case and circuitry rank it as a true PC AT clone. Styling, layout, and expansion all match the IBM PC AT standard. The only readily apparent differences are its speedier performance, lack of ROM BASIC, and

lighter-weight keyboard.

Of course, the CD/286 is based on the
80286 microprocessor and has a weart
socket for an 80287 numeric opporters.
The 10-MHz speed can be reduced to 6
MHz with a keypress to accommodate finitely, software (if such stuff still exists).
You can make the big swich even within an application or a disk access. Most off the
system support circuity is contained as the system support circuity is contained gies—the critical components stamped
with a "10 MHz" label.

Four banks of nine sockets comprise up to 1 megabyte of parity-checked system board RAM memory. Only two banks are filled with 120-nanosecond 256K-bit chips in standard configuration. Memory expansion must take the form of 18 additional 256K-bit chips.

The full memory endowment can be split, with either 512K bytes consigned to DOS and 512K to extended memory, or a



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full 640K given over to DOS and 384K to extended. A single DIP-switch bank sets system options, including the memory split, size of ROM chips used, and the default display.

and tubble 20 Medical time a pair of 256Kbit RQM claips that are physically bear sain of the RQM claips that are physically bear sain of the RQM claips are physically bear sain of the RQM claips are perfect to a fine with portions attributed to Computer Dulers: the code exhibited no outward prolems during testing and proved compatible with both DQS 3 and all the applications that we tried. As with all compatibles, the CD256 lacks RQM BASIC and is not compatible with the BASICA included with DQS.

Eight expansion slots are arrayed on the system board. Two on the left use the PC-XT-style 8-bit data bus, and the rest use a full 16-bit data bus. All are full length and full PC-AT height. Supplied as standard equipment, one 16-bit slot is filled with a combined floppy/hard disk controller. No

other expansion options are offered.

At the right rear inside the chassis is the chrome-plated metal box of an Astec power supply rated at 200 watts. For mass storage, provision is made for adding a full-height internal disk drive bay and three half-height bays on the right, two of which can be accessed through the front panel.

All disk drives are mounted using hardware identical to that favored by IBM: slide-in mounting rails held in place by small brackets at the front, which means that most after-market products should just slide into place.

Computer Direct supplies a high-density, 1.2-megabyte floppy disk drive as standard equipment. The evaluation unit was equipped with a half-height Lapine 20megabyte hard disk in the internal disk drive bay.

LACKS ATTENTION TO DETAIL. The mechanical workmanship of the CD/286 can best be described as adequate because it shows a definite lack of attention to described. The instance, inside the valuation of the control of t

The case and retaining brackets of this machine were secured with what must be cut-rate hexagonal-headed screws—the slots were cut no shallow to give an average screwdriver a good grip. Worse, the screws must have been twisted into place by Rambo's weight-trainer weighding an impact wrench. You'll be likely to need a quarter-inch nut driver (as we did) to remove these screws when adding expansion cards.

The setup program for the CD/286 is encoded in ROM firmware and can be called up at any time by pressing CHr.Alt. Enter. With the simple menu system, you can configure the hardware options of the CD/286, park the heads of the hard dish of the configure the hardware options of the CD/286, park the heads of the hard dish an application, however, the return is far from deegan, with the secreen turning into a conceptual to the configuration of the configuration of the configuration of the setup routines while within 1-2.3.

Neither monitor nor adapter is supplied with the base model CD/286. The evaluation system, one of several turnkey packages offered by Computer Direct, was equipped with a dual-mode color-andmonchrome/graphics board (Hercules compatible) with a built-in printer port.

On its bottom, the Computer Direct keyboard was labeled as made by Maxiswitch. On top, the key layout conformed precisely to the 84 keys of the original AT with ten left-hand function keys, enlarged Enter and Shift keys, and shift-state indicators at the upper right. The keyboard is lightweight and its touch is better than average, with a nice snap-over action but lit-

the audible feedback.

Perhaps the most surprising—and
though-provoking—aspect of the CD/286
is the similarity of its system board to that
of the PC's Limited 286-10. They appear
identical, right down to the silk-screened
copyright message that Computer Direct
hides under a tab of metal foil emblazoned
'Warranty Void if Removed." Turther,
both computers bear exactly the same FCC
Class B estrification number.

The CD286 may find is best application as a foundation on which computer tinkerers can build the systems of their dreams at the lowest possible cost. One caveat, however. The Lapine hard disk that came with the evaluation unit ram with BIOS errors, and we could not obtain a replacement disk from Computer Direct. The compuny says it is working on new technologies, so the future availability of this model is uncertain.

KAYPRO CORP. Kaypro 286i

Back when CP/M was king of the operating systems for small-business computers (remember CP/M?), Kaypro Corp. moved into the computer business with an affordable portable computer packaged with a wealth of software. While the biggest competitor from those bygone days, Osbome, has fallen by the wayside, Kaypro







has plodded steadily along. The Kaypro 286i is the company's latest creation. The Kaypro 286i Model C, which we received for review, packs a plethora of programs into one affordable package, just like earlier er Kaypro models. The basic system, designated Model A, is physically identical except for hardware and software options.

As you'd expect, the microprocessor of choice in the 286 is an 80286, operating at 10 MHz with one wait state. Unlike most other fast systems, the 286 ic ant 18 slowed and always runs at its lickety-split speed. However, you can speed up some of the software you run on it by adding an 80287 numeric coprocessor to an empty socket on the system board.

Standard memory in both 286i models is 640K spread among four banks of nine socketed 256K-bit DRAM (dynamic RAM) chips, a mixture of 100- and 80-nanosecond versions in the evaluation machine. The excess memory beyond the DOS limit is apparently unused and un-available.

Styling on the 286i system unit is similar to the IBM PC AT's—the case and its layout match, but details and colors don't. The front panel is a greenish-beige, its ventilation dots are bent and skewed, disk drives are finished in basic black, and the spans there half-height units. Otherwise, spans there half-height units. Otherwise, the face is familiar and includes a small left-hand control panel with cylindrical keylock, drive activity, and power indicators. On the rear panel, three cutouts for DB-25 connectors are available but blocked off with screwed- on panels.

The system board itself is made in the U.S.A. by Kaypro and is based primarily on discrete components. The BIOS also bears a Kaypro copyright and proved compatible with DOS 3.2 and all IBM applications that we tried. Two extra sockets are available for adding your own firmware.

Eight full PC AT-height expansion stos are supplied—wox 8-bit sloss, and the rest using the entire 16-bit PC AT bus. In Model C configuration, one 8-bit slot niled with a Kaypro-made parallel-and-serial adapter card. As with the IBM PC AT, the parallel port uses a female DB-9. Enenctor and the serial port a male DB-9. In both 286 in odels, one 16-bit slot is occupied by a Western Digital WD1003 combined florow/hard disk controlled.

■ If you're looking for unchangeable fast speed and an assortment of fine software programs at a reasonable price, the Kaypro 286i is an appropriate choice.

51/4-inch, high-density (1.2-megabyte) floppy disk drive. The Model C adds a Seagate ST-4038 30-megabyte high-performance hard disk.

System configuration information, which is set with a utility program run from the DOS prompt, is stored in a 64K-byte block of static CMOS (complementary metal oxide semiconductor) RAM. This memory and the system clock are kept alive when the machine is off by a small lithium battery that is attached inside the rear panel of the chassis by Veden.

EXCELLENT SOFTWARE The big bonus with the Model C is its software endowment. It features a very good, if aged, word processor—venerable Wordi-Star—as well as its companion programs, MailMerge, Correctbur, and Star Index. The software complement is completed with Mite, a communications package; PolyWindows Deck Plus; GW-BASIC; and MS-DOS 3.2. Only the last two are included with the Model A.

The only substandard item supplied with the 286 is the keyboard. Made in Taiwan by BTC, it conforms to the original PC AT 84-key layout. Its touch is its own, however, with a linear feel that gives neither tactile nor audible feedback. At best, it rates as acceptable for everyday use—leters at least appear on the screen when you press the keys.

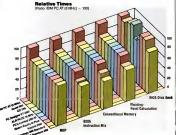
If you're looking for unchangeable fast speed and an assortment of fine software programs at a reasonable price, the Kaypro 286i is an appropriate choice.

■ 10-MHz COMPUTERS



Benchmark Tests: 10-MHz AT Compatibles

The NOP lest shows the true measure of comparative processor speed among in 6 MeV machines. As expected, aftroin a 16 MeV machines. As expected, aftroin a 16 MeV machines. As expected, aftroin 6 MeV machines are supported in 6 MeV machines. As the support of the 16 MeV machines are supported in 6 MeV machines. As the 16 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines are supported in 6 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines are supported in 6 MeV machines. The 16 MeV machines are supported in 6 MeV machines are sup



Performance Times

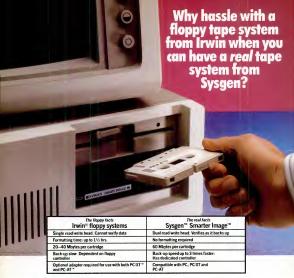
(Times given in seconds except where noted)

Product	NOP	8088 Instruction Mix	Convectional Memory	Floating- Point Colculation	BIOS Disk Seek (millisaconds)
IBM PC AT (6 MHz)	4.20	9.00	1.30	36.00	37.00
Accel 900	3.35	7.25	1.02	28.21	34.48
CD/286	3.35	7.20	1.02	28.01	N/A
PC Designs ET-286i	3.35	7.19	1.02	28.01	37,34
ALR PC2E/10 MHz	3.35	7.17	1.02	27.96	38.92
PC's Limited 286-10	3.35	7.17	1.02	28.01	30.20
Epson Equity III Plus	3.35	7.14	1.02	28.01	32 46
Kaypro 2861	3 35	7.14	1.01	27.99	37 08
Proteus Technology 286 Standard	3.35	5.88	0.86	22.60	36.73
AST Premium/286	3 35	5.69	0.74	22.41	30.14

The MOP benchmark test is designed to measure raw clock speed and memory access time while minimizing offerences in microprocessors and the effect of memory caching. This set executes nothing but NOP ("No Operation") machine sode instructions in a big 128K loop.

The 8086 Instruction Mix benchmark test measures the in it takes to execute a selected series of processor-intensiva tasks. The test program uses 8086 instruction code. These instructions are a subset of the total processor instruction is The Conventional Memory benchmark test elocates 255K bytes of conventional memory and treets it as a series of 64-byte records. Then 16,354 random records are read into and within from this memory. The result shown is the average

The Floating-Point Calculation benchmark test measures processor speed by looping through a similer of floating-point calculations, including multiplication, division, exponentiation, and logarithmic and ingonometric functions. The benchmark program uses the floating-point library included with Microsoft he BIOS Disk Seek benchmark test measures the time it ikes to do a random seek using the dark ROM BIOS. The st result includes marinal software overhead and may not sraflet the marutacturer's claimed average access time. The all program performs 1000 seeks. The average result is sown in miliseconds.



Back-up buyers beware!

Some back-up systems that run on your computer's floopy controller cannot verify the data after it is written to the tape. Errors go undetected, so users won't know if they've recorded accurately until it's too late.

With Smarter Image, you know you have accurate backup data because reliability is built-in. The system features two read/write heads; one records data while the other verifies the accuracy of your data as it's written.

And Sysgen, the pioneer of automatic tape back-up, lets you program back-ups as simply and conveniently as a VCR, saving you the worry of forgetting

In addition to superior back-up protection, Smarter Image offers you cassettes that don't require formatting and faster back-up speeds for far less waiting,

And a full 60 Mbytes lets you store up to three times as much as competing systems, giving you the ability to

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Literature Hotline: 1-800-821-2151 Dept. 57

■ 10-MHz COMPUTERS

PC'S LIMITED PC'S Limited 286-10

While IBM's line of 80286-based computers to soo ut at 8 MHz, that's where the product line of PC's Limited begins. The PC's Limited 288-10 fits in the middle of that Austin, Texas-based computer manufacturer's AT-compatible line, filling whatever niche there might be for people who want better-than-IBM performance but don't want to go all the way to a 12- or 16-MHz maching.

As with all AT compatibles, the 286-10 is based on Intel's 80286 microprocessor. Although its top speed is set by firmware to 10 MHz with one wait state to accommodate common memory chips, you can also slow the 286-10 by a keypress to 6 MHz. You can make the switch any time after booting up, even within applications or during disk access.

An empty socket is available for an 80287 math coprocessor.

Standard memory in the 286-10 consists of 1 megabyte in four fully socketed parity-checked banks of nine 120-nanosecond 250K-bit DRAM (dynamic RAM) chips. The system supports two memory configurations that are DIP-switch selectable: 512K bytes consigned to DOS and 512K to extended memory, or a full 640K for DOS and 384K for extended.

The system board is designed around the Chips and Technologies VLSI CHIP-Set, and the BIOS, locked into a pair of 256K-bit ROM chips, bears a copyright shared by PC's Limited and AMI. In PC Lasts tests, it demonstrated no bad habits and proved itself capable of running DOS 23. Neither an operating system nor BA-SIC is included with the machine, and no vacant ROM sockets are available.

The expansion area of the 286-10 matches the current industry norm, eight full-length stots: two of which use the PC-XT-style 8-bit data bus, and six the PC-AT-style 16-bit bus. All are tall enough to accommodate PC-AT-height boards coept the leftmost 8-bit slot, which has a chassis-stiffening bar above it. This height limitation should not be a problem if this slot is used for a display adapter, as it was in the evaluation sample.

The rightmost 16-bit expansion slot was filled with a standard-equipment Western Digital WD1003-style combined floppy/hard disk controller. All other slots were vacant.

Electricity for the whole system is produced by a 220-watt power supply made in California by Tri-Mag.

The styling of the PC's Limited 286-10 most resembles that of a truncated PC AT: it's squared off, colored a pale two-tone gray beige, and has numerous vertical ventilation slots in the front panel. Near the upper left of the machine is a monitor panel adomed with a system keylock plus power and disk activity indicators.

SMALL FOOTPRINT The 286-10 by 18½ by 16½ inches (HWD)—primarily by 16½ inches (HWD)—primarily by chopping out the space normally assigned to the PC AT's internal hard disk drive bay. The remaining right-hand disk drive bay provides space for three half-beight devices, with only the top two having front-panel access.

The standard disk drive in the 286-10 is a high-density (1.2-megabyte) 5¼-inch floppy disk drive. The evaluation machine was also equipped with an optional highperformance full-height 40-megabyte Mi-

supplies a driver that makes the area beyond the DOS 32-megabyte limit accessible as a virtual second drive.

The disk devices mount with guide rails identical to those used in the Compaq Deskpro 286—slightly larger than those of the IBM PC AT—and are secured by the simple but effective scheme of driving screws through the side of the disk drive hav and into the rail.

PC's Limited augments the modest IBM arrangement with two additional displays that make its machines stand out



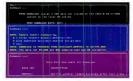
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MORE 10-MHz MACHINES: COMPLETING THE PICTURE

Four other computers with top operating speeds of 10 MHz have come under scrutiny by author Winn L. Rosch. Here are short summaries of his views of those machines.

ADVANCED LOGIC RESEARCH INC. ALR PC2E/10 MHz

Advanced Logic Research's 80286based PC-XT compatible, the ALR PCZB/10 MHz (first reviewed in "The In-Between Machines: 80286-Based XT Compatibles, PC Magazine, Volume 6 Number 4), was named an Editor's Choice at that time for its excellent performance.

Although it is exactly the same size as a PC-XT, the PC2E/10 MHz looks much like a miniature PC AT and performs like one. At top speed the machine will beat IBM's best by up to 30 percent.

Inside, two side-by-side full-height disk drive bays are available. Only the right one is divided in half and open to the outside. The left bay is designed solely for full-height davice.

Power users will appreciate the 1 megabyte of RAM factory-installed on the board but may be disappointed by the fact that only five expansion slots are available, three 8-bit and two 16-bit.

The only truly substandard component of the PC2E/10 MHz is its key-

ALR PCZEJOMITZ

board. Laid out like the original AT keyboard, its feel and workmanship are not up to par. The computer deserves better. At \$2.995, with display and hard disk, the PCZB/10 MHz is a burgian, especially when you consider its speedy performance. This coincidence of low price and high performance makes this computer worth a look.

Epson Equity III Plus

Epšon America's todally redesigned Equity III Plus (first reviewed in "Epson Does It Again," PC Magazine, Volume 6 Number 4) generates true excitement with 10-MHz performance at a bargain price of \$2,595. Add another \$1,200 and you get an enhanced model with a highperformance hard disk that leaves IBM in the disk

The system unit contains Epson-developed VLSI circuitry and a novel board layout that leaves room for five halfheight devices, three of them accessible from the outside.

Nine expansion connectors are in-



cluded: three with the PC-XT-style 8-bit bus and six with the full 16-bit PC AT bus. All of the slots run the full length of the chassis.

The Equity III Plus microprocessor operates at either 6, 8, or 10 MHz with one wait state. Even though it isn't the fastest AT compatible on the market, it can outperform the IBM PC AT by a respectable 25 percent.

Standard equipment includes a single high-density floppy disk drive and a 101key keyboard that closely matches the new IBM Enhanced Keyboard layout.

Overall, the Equity III Plus is a trendsetting and competitive computer with an excellent future. It contains all the ingredients of Eoson's formula for success.

MULTITECH ELECTRONICS INC.

Accel 900
Multitech Electronics' Accel 900 (first

reviewed in "AT Alternatives: Extra Features and Cheaper, Too," PC Magazine, Volume 6 Number 3) is a solid machine that is functionally equivalent to the IBM PC AT, with a laundry list of extra features. It has the same standard con-



Accel 900

ALK PCZE/10 MHZ

figuration as many of the other AT compatibles reviewed here: 512K bytes of RAM, combination floppy/hard disk controller card, keyboard, and 1.2megabyte floppy disk drive. It also includes a high-resolution monochrome monitor, MS-DOS 3.2, and PC-Write, a popular word processine program.

Inside the Accel 900 is a conventional layout that includes eight expansion slots (two 16-bit and six 8-bit), one full-height drive bay in the center, and three half-height bays stacked on the right, arranged exactly like the IBM PC AT.

The design of the 97-key keyboard falls between the new AT style and the old PC-XT style, with function keys on the left and separate cursor control keys. The Accel 900 is a fine machine over-

The Accel 900 is a fine machine overall. It can be a good investment in desktop data processing for an individual or a whole department.

PC DESIGNS INC. PC Designs ET-286i

The PC Designs ET-286i (first reviewed in "AT Allematives Extra Features and Cheaper, Too," PC Magazine, Volume 18 MPC AT. Standard equipment includes 512K bytes of RAM, a PC AT-style keyboard, and a 1.2-megahyte floppy disk drive. At \$3.145 for a configuration that includes a Princeton Graphics



PC Designs ET-286i

■ The ET^a286i's most interesting feature is the unique configuration

of memory chip sockets.

megabyte hard disk, the ET-286i holds its own in the cost competition.

The ET-286i's most interesting feature is the unique configuration of memory chip sockets on the motherboard, which are capable of handling 1-megabit dynamic RAMs. This type of motherboard allows up to 4 megabytes of RAM for Xenix, UNIX, and other multiuser operating systems. You can toggle the 10-MHz clock speed down to 8 or 6 MHz by hitting CTI-Shift-ALDel.

Two 16-bit and six 8-bit expansion slots fill the chassis, and all of them are full AT height. A wealth of ports, two parallel and three serial, are also standard. A wide variety of hard disk storage options are available, including high-performance disks from Core.

The ET-286i outperforms the IBM PC AT and comes with a moderate package price tag. Although it could use a little more attention to detail, it remains a likable and hardworking system.



FACT FILE

ALR PCZP/10 MHz
Advanced Logic Beatearch Inc.
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Epson Equity III Plus Epson America Inc ater Produ cts Division 2780 Lomita Blvd. Torrance, CA 90505 (213) 539,9140 List Price: Base model with 640K RAM, \$2,695. With 40-Mbyte drive, \$3,895 Monitor and adapter card not included In Short: A three-speed (6-, 8-, and 10-MHz, all with one wait state) PC AT con patible with a hard disk drive controller as ndard equipment. Excellent flexibility and interesting upgrade possibilities. It's CIRCLE 673 ON READER SERVICE CARD

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In Short A unmice y 10-Mile Pc AT public age that if much by history laboration computer monifications.

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■ 10-MHz COMPUTERS

from all the competition (including IBM). Called SmartVU, the extra indicators include a four-segment alphanumeric display and a set of LED chase lights. The alphanumeric display gives an amazingly accurate readout of diagnostics during power-up, duplicating the monitor display. The LED lights monitor system interrunte

As is increasingly becoming the practice in the AT-compatibles industry, the setup program for the 286-10 is built into its ROM firmware. The various routines-which include hard disk head parking, defeating memory parity checking, and switching off the scanning red lights of the SmartVU panel in addition to normal setup-can be activated within most applications by pressing the Ctrl, Alt, and Enter keys simultaneously.

A display and adapter are not included in the 286-10 standard configuration. The evaluation unit was equipped with a PC's Limited EGAds! board, an enhanced graphics adapter.

The keyboard that came with the 286-10 was manufactured by Maxi-Switch and conformed exactly to the original PC AT keyboard layout. Ten function keys were arrayed on the left; the Shift and Enter keys were appropriately enlarged; and indicators were provided above the combined numeric/cursor keypad at the right side. The touch proved very good, with a positive over-center feel but little audible feedback. While it weighed substantially less than the IBM keyboard (what doesn't?), typing on it was pleasant.

SUPPLIES LIMITED Time may be running out for the 286-10, however, PC's Limited, which makes 8-, 10-, 12-, and (in ultra-limited quantities) 16-MHz AT compatibles, appears to be phasing out (or at least down) the 10-MHz 286-10 and pushing the 286-12. If you want less speed, it will cost you more. A sales representative at PC's Limited explained that while several package deals that include a monitor and hard disk are available for the firm's 8and 12-MHz computers, the 286-10 will cost over \$3,800. However, an equally equipped 286-12 (which can be throttled back to 6 MHz if compatibility requires) will cost only \$3,595.

Nevertheless, the PC's Limited 286-10

proved to be an affordable and compact AT alternative, well made and essentially quirk-free. The SmartVU will help you tell a crashed computer from a program that works in mysterious ways, and it should alleviate most of your fears of mail-order support. While PC's Limited customers had rocky experiences a year or two ago, the company has done a lot of growing up.

PROTEUS TECHNOLOGY CORP. Proteus Technology 286 Standard

Custom-made to your order is how Proteus Technology Corp. offers its products. Call the company and tell it the options you want, and its staff will assemble a computer to match, burn in the complete system (not just the system board), and send it to you with a 30-day money-back guarantee, 15-month warranty, and 60 days of free on-site service through Computer Mainte-

nance Com The starting point for all its systems, including the Proteus Technology 286 Standard, is an Applied Computer Solutions (ACS) system board equipped with an 80286 microprocessor running either at 10 MHz with one wait state, or at 6 or 8 MHz with none. For \$200 extra, a stepped-up model, the 286-10-0, will add zero wait state performance at 10 MHz.

Unlike most AT compatibles, the ACS board is crammed with discrete components instead of just a handful of VLSI chips. A socket is available for installing an optional 80287 math coprocessor. The evaluation system had a 10-MHz 80287 with a small printed circuit board of highspeed support.

One megabyte of RAM is contained on the system board in four banks of nine 100nanosecond 256K-bit memory chips. All of the chips are socketed in oversize sockets that will accommodate megabit memory chips (when they become widely available) to push system board memory capacity up to 4 megabytes. Even more RAM, up to 16 megabytes, can be added with expansion boards

Also built into the system board are three serial and two parallel ports. The serial ports use PC-XT-style male DB-25 connectors installed in the back panel to conserve expansion slots. The parallel ports are equipped with IBM-standard fe-

Technology 286 Standard offers eight expansion slots and a wealth of ports: three serial and two parallel. Qua internel full bainly and two external halfhereht drive bays are available. The NEC MultiSync monnor is

The Proteus

optional.



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■ 10-MHz COMPUTERS

 Proteus Technology's 286 Standard should be capable of veoman service as a turnkey system. It ran all of our test software and DOS 3.2 without a hitch.

male DB-25 connectors installed in two expansion-card retaining brackets. The three serial ports are configured as COM1, COM2, and COM3, the last of which is not supported by DOS or most PC software. All ports are plainly labeled with their DOS designations on the rear panel of the 286 Standard

The ACS system board includes connectors for eight expansion slots, two of which use the PC-XT-style 8-bit data bus, and the rest use the full 16-bit bus of the PC AT. One of the (electrically) wider slots is devoted to a combined floppy/hard disk controller on a 5-inch-long short card made in Japan by National Computer. In

typical 286 Standard configurations, one of the 8-bit slots will be given over to a display adapter board.

The chassis is a close match to that of the IBM PC AT. Color and styling are nearly identical, including the small control panel in the upper left that has a system lock as well as disk activity and power indicators

As with the standard PC AT design, two disk expansion areas are available to the user: an internal full-height disk drive bay and a bay on the right with room for three half-height devices, giving front-

panel access to the too two. Standard equipment in the 286 Standard includes a 51/4-inch, high-density (1.2-megabyte) floppy disk drive in the top slot and a 51/4-inch, double-sided, doubledensity (360K-byte) disk drive underneath. Several hard disk ontions are available. The evaluation system was equipped with a Seagate ST-4038 30-megabyte fullheight hard disk that proved to be a good match for the overall performance of the

system. The power supply, located at right rear is an Astec 200-watt model.

As with most AT compatibles, system configuration information is stored in CMOS (complementary metal oxide semiconductor) memory. This tiny block of memory and the built-in time-of-day clock are kept fresh by a lithium battery that is attached inside the rear panel of the 286

Standard by a Velcro pad. Configuring the 286 Standard requires running a setup program that is contained in the BIOS firmware (which bears a Proteus copyright on the chip). The setup program can be started at any time after boot

up by pressing a combination of four keys. Underneath the Proteus label of the keyboard accompanying the 286 Standard is the name Quimax. Its 84 keys are laid out in the same pattern as that of the original IBM PC AT keyboard, although its styling is a bit more square. Its touch is positive but linear and lacks both tactile and audible feedback. It's satisfactory but not outstanding for typing upon.

The Proteus documentation appears aimed at the beginner. It starts with computer fundamentals and is clearly written. but lacks the depth of technical detail a



- AST Premium/286

The nine 10-MHz AT compatibles included in this review carry a significantly lower FUD (fear, uncertainty, doubt) factor than the 12and 16-MHz machines we reviewed in the last issue. Although some speed demons will continue to scoff machines are readily available, sometimes at an equivalent price,

at 10-MHz machines when 12-MHz full compatibility is a real issue and it shouldn't be ignored. The computers in this group presented no compatibility problems at all: the same cannot be said for every 12-MH: computer and certainly not for every 16-MHz machine When fit and finish count, be pre-

pared to pay at least \$2,500, at which price both Multitech Electronics' Accel 900 and the AST Premium/286, from AST Research. seem appealing. As a turnkey system, the Accel 900 is the less-expensive alternative (but not by much) and features an exemplary keyboard and monitor. However, the Premium/286 is without a doubt the best-looking and best-performing system with a 10-MHz rating. Its quality makes its price a bargain.

The 286 Standard should be capable of yeoman service as a turnkey system (although the evaluation unit we reviewed lacked an FCC certification sticker). It ran all our test software and DOS 3.2 without a hitch. The custom-manufactured approach and availability of on-site service make it an excellent choice for someone who wants to configure his own system without messing around with the intricacies of matching hardware.

Winn L. Rosch is a contributing editor of PC Magazine.

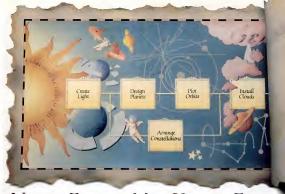


Proteus Technology 286 Standard Proteus Technology Corp. 377 Rte 17 Hasbrouck Heights, NJ 07604 (201) 288-8629

List Price: With 1 Mbyte RAM, one 1.2-Mbyte floppy disk drive, one 360K-byte floppy disk drive, \$2,195, 30-Mbyte hard disk, \$389, 44-Mbyte hard disk, \$595, 80megabyte hard disk (used as a server), \$995. 14-inch high-resolution monochrome m tor, \$159, RGB monitor, \$345. Quantity discounts are available for NEC MultiSync

monitor, \$585. Requires: DOS 3.0 or later

In Short: A custom-made 10-MHz (onewait-state) AT compatible that also operates at 6 or 8 MHz with no wast states. CIRCLE 650 ON READERSHIP/CE CARD



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■ BACKUP SOFTWARE

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PC Magazine's own BAC.COM beats DOS in handling routine backup chores.

If you measure your backup reeds in terms of 10-megabyte files and hard disks that harbor 1.500 subdirectories, our leasure to go for once of the large-you files are to go for once of the large-reviews in this itsue. But If you need to handle those naging little backup chores so that you'll never find yourself in a debititizing my-dard-isappeared funk-you'll cheer the simplicity and ease of building my-dard-isappeared funk-you'll cheer the simplicity and ease of BAC_COM_A backup program by contributing editor John Dickinson, does the job for simple backup tasks, improv-

contributing editor John Dickinson, does the job for simple backup tasks, improving on the slow, flawed DOS BACKUP program. Taking a cue from one alternative to BACKUP, DOS's COPY com-

CUTING TOO DEEP These time-saying techniques can be very effective: in
some cases they cut backup time by a factor of 20. Reliability is another matter,
however. In the all-out effort to shave
backup seconds, some programs forgo the
safeguards that help maintain disk integrity. The most unexpected result in testing
this software was the perfl in which some
of the programs may leave your data. Sevenal of these backup systems had difficulty

restoring from floppy disks data that had been written only minutes before. Of particular interest was the manner in which various programs dealt with disk errors. A few gave no warning that something might be wrong with a disk-even when the program formatted the disk during the backup process-and proceeded to use all sectors, bad or not. Better programs detected such errors during the backup and rejected the defective disks. The best detected the errors, marked the bad sectors, and continued without a hitch-albeit with less capacity on the defective disk. The same was true during the restoration process. When some programs detected disk errors, they called a halt to the restoration. leaving no way to salvage anything from the bad session. On the other hand, the best of the lot, Core International's Corefast,

mand, BAC COM keeps your backedup files DOS-readable and supports the " and ? DOS wildcard characters. Going COPY one better, it lets you easily comtinue the backup on a new floppy disk when your target disk is full. Plus BAC COM sidesteps another COPY drawback: it won't make the mistake of overwriting a file that has a more recent time-/date starup with an older version.

In a word, BAC.COM is super—and it's free. You can download the handy program by modem from the PC Magazine Interactive Reader Service. It's also included with The PC Utilities, Volume 1, available from PC Labs.

—Craie L. Stark

could detect and correct such errors, restoring everything perfectly even from a disk gone bad.

BIGFILE AND SCATTER The test setup was relatively simple. We used an 8-MHz AT compatible with a standard 20megabyte AT-style hard disk drive manufactured by Computer Memories Inc. (a particularly apt test bed given the CMI disk's propensity to die in early PC ATs). The hard disk's rated average access time is 40 milliseconds; this particular unit clocked at 43.3 milliseconds. To back up the hard disk, we used a 1.2-megabyte floppy disk drive. A Western Digital WD10002 combined hard and floppy disk controller governed both disk drives. Before the backup session was started, we formatted our floppy disks, using either DOS or the format utility included with the particular backup system. The results thus reflect the fastest backup possible with each system.

Testing involved backing up two different hard disk environments: Bigfile, consisting of one file exactly 10 million bytes long, and Scatter, a hierarchy of 1,578 subdirectories, each filled with two files 2,048 bytes long. The former is an extreme case of a system based on a few large



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files; the latter, a system made up of many small files and subdirectories. Results in actual systems should fall between the results for these two.

Note that the results obtained will not

reflect the backup times to be expected from a PC system, because of the higher processing speed of the AT, the faster data transfer rate of its floppy disk drives, and the wider, 16-bit data channel connecting the AT disk controller to the host system. The rank-order relationship among the various programs' performances should be the same, however, because the speedup techniques are equally effective for both systems.

Backup times will also vary depending on the number of disk buffers specified in the host system's CONFIG.SYS file. For instance, with BUFFERS=2, Fastback required more than 88 minutes to back up Scatter, with BUFFERS=20, it needed about 6 minutes. For the sake of fairness. we tested all programs with BUFF-ERS=20, even if their automatic installation routines set a different figure (they varied from 16 to 40). (If you do not have a buffers statement in your CONFIG.SYS file, your system will default to either 2 or 3 buffers, depending upon the computer and version of DOS you are using.)

One variable could not be controlled-the time required to swan flonov disks. However, the same person (me) conducted all tests from the same chair in the same relationship to the disk drive, always having a sufficient stack of floppy disks waiting. I timed several dozen disk changes and found the time for each to be within 1 second of 5 seconds. Thus, the variance in the time required for disk changes amounted to less than 1 percent of the total backup time.

The following reviews are in alphabetical order by product name.

Backup Master

Underlying the design of Intersecting Concepts' Backup Master is the philosophy that you'll make more backups if they are less boring and time-consuming. The \$89.95 program seems designed for the utmost in backup speed and succeeds amazingly at meeting its aim. In addition to a DOS-compatible backup mode, it features a high-speed mode that's claimed to cut backup time by a third, using, among other acceleration techniques, a proprietary disk format.

In our tests, however, the high-speed mode sacrificed something more important-reliability. We couldn't successfully restore any high-speed backup of the Bigfile environment, even after three different backup sessions. Each of these backups re-

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warded us with a stack of floppy disks that was purportedly security against the worst; yet even when we immediately tried to restore Bigfile, the program reported data rors and halted the restoration. The same disks had worked when testing other back-up programs. Moreover, the errors appeared on different disks with each unsuccessful backupy restoration cycle.

Intersecting Concepts president Mark Graybili says that the figh-speed resolution problem could have been the result of working on a non-IBM AT clone (although currently more than half of all computers sold are non-IBM machines). He also said that Version 2 of Backup Master will be released soon and may resolve

some of the problems. High-speed restoration problems aside, however, Backup Master is a friendly and convenient program with both menu-driven and command-based options. Choose the menus, and after you start the program you'll need only to select from among the various choices on the screen to make a backup. Odds are you won't even need to glance at the context-sensitive help system. A special setup menu allows you to configure the defaults so you don't have to wander through the whole menu system each time you run the program. Or another program option records each keystroke that you make. Later, you can use that recording to make backups automatically from the DOS prompt or from a batch file

You can select any or all files to be included in or excluded from your backup.



Furthermore, Backup Master gives you unusual control over DOS's file archive bit. You can use the bit to pick files to back up or not, then reset it or leave it alone when you're done.

When using the DOS-compatible mode, you'll need a stack of preformatted double-density or high-density floppy disks. In high-speed mode, Beckup Master will either add its own special format on fifty, which imposes a substantial speed penalty, or reuse disks that have previously been formatted on the fly. The program offers no option for preformatting floppy disks.

For restorations, Backup Master gives you a similar plethora of options, including date-stamp-keyed overwriting of existing files. As with nearly all backup programs, it will completely re-create your original disk directory structure or merely restore a single file. A backup disk, helps you find individual files for restoration.

Corefast

Originally designed as the operating softoriginally designed as the operating soft-Corofistr was adopted by its manufacturer, hard disk system integrator Core Internates that the contraction of virtues: speed, versatility, and reliability.

reliability. Not only is Corefast much quicker than DOS, it offers more backup modes than any other package reviewed here. Floppydisk-based backups can be made at either of two speeds: a slower, DOS-compatible mode that uses normally formatted (and readable) disks and a higher-speed mode that ups capacity modestly and kicks in much quicker performance. The highspeed mode requires specially formatted disks, however-and although you can format them on the fly, this increases backup time to nearly that of the DOS mode. A utility function allows preformatting disks for high-speed backups. And unlike other utility programs (such as Pdisk, examined here) that reject an entire disk when an error is encountered in formatting, Corefast merely marks bad sectors in the manner of

DOS's FORMAT command.

Like earlier Core International backup software, Correlar permits both file-byfile and disk image backups. And in addition to standard file-by-file restorations (image restoration can be made only to disk partitions identical in size to the original), the program allows file-by-file restorations of image backups (limited, howerer, to 250 files per restoration session).

Corefast can be run in either commandor menu-driven mode. The latter relies heavily on function keys to select operating parameters and gives context-sensitive help at the press of F1. The control hierarchy here, which often requires an elaborate string of function-key presses, is probably the program's weakest link. It is at its worst when preformatting disks for highspeed use. Instead of allowing you to encode a whole stack of disks at once, it drops you back to the main menu after each disk and again makes you pick your way to the format function. Of course, the menu-driven mode almost eliminates the need to plance at the unusually understandable documentation. Still, power users and other impatient people will probably prefer the command-driven mode.

Both modes provide all of the various DOS backup options. You can select files for backing up by date, with the choice of before or after the given date, or by archive bit (which denotes whether the file has been changed since the last backup). Sub-



CIRCLE 492 ON READER SERVIC

■ BACKUP SOFTWARE

directories can be searched at your option. A cataloging feature allows you to specify groups of files to be backed up (or re-

stored) automatically. An additional utility puts your system in a waiting mode to make backups at an appointed time. Because the wait program runs in the foreground, you cannot use your PC while it's biding its time. This feature is useful primarily for backing up to a nonfloppy device, such as a tape drive or

another hard disk The Corefast system's reliability is enhanced by an optional error-correcting protocol and a verification procedure that ensure backup integrity. The former seemed to impose no penalty on performance and proved quite effective. When disk errors cropped up during a restoration, the program flagged them on-screen and, commendably, corrected them. The completed restoration was entirely error-

While not the fastest backup program tested in this batch, Corefast did make the quickest restorable backup, using its non-DOS high-speed mode. It also handled the Scatter directory hierarchy in both its image and file-by-file modes, although the latter required nearly twice as much time as did the quickest program (Backup Master). The price may seem high for a backup utility, but Corefast earns its tag with features and reliability.

DSBackup Plus DSBackup Plus is Design Software's attempt to improve on the standard DOS utilities. The program operates somewhat faster than DOS (although hardly three times as fast, as the manufacturer claims). will make backups on any DOS device, lets you squeeze files along the way if you desire, and costs \$79,95. When making backups to floppy disks, the program estimates the number of floppy disks you'll need before you start. Should you not have enough formatted disks on hand, you can format as many more as you need without leaving the program.





DSBackup Plus Design Software 1275 W. Roosevelt Rd. West Chicago, IL 60185 List Price: \$79.95

Requires: 256K RAM: In Short: Two programs in one, DSBackup Plus includes both a high-speed backup utility and one that's DOS compatible. Not copy protected

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DSBackup Plus operates either as command driven (from the DOS prompt or in butch files) or a smeul driven, You get all the expected file handling options, including subdirectory searches (with or without prompting for each directory) and file selection by archive bit. The program can generate a hard-copy report of the entire backup session. It also offers on-line help.

During testing, however, DSBockap, Plus proved quity, and unreliable, Polica pol

Furthermore, the Restore option was hardly trouble-free. Immediately after

making an ordinary backup of Bigfile, we attempted to restore the file. When a disk error came up on the second floppy disk, DSBackup Plus canceled the entire session. Had we been trying to restore our only copy of important files, we would have been sunk. Worse, the program left about a megabyte's worth of hard disk sec-

about a megabyte's worth of hard disk sectors marked as in use but unattached to a flie; they had to be cleared with CHKDSK. Although the program does provide a veriry option, and although other restoration attempts from different backup sessions were successful, we would not feel safe using DBackup Plus while keeping only one copy of important files.

The squeeze feature also proved of dubious value. Selecting that option didn't reduce the number of disks required to back up Bigfile. Moreover, the program incorrectly estimated the number of disks required, because its guess did not take into account the use of hish-density disks (which it did when the squeeze option was

not selected).

Design Software also supplies a companion program called Speedbak that
achieves much higher backup speed by
abundoning the standard DOS disk format.
Although we would guess that this feature's performance should guess that the couldn't be come
formation of the program to use highdensity floopy disks and though the screen
out frost test disk as merely double density.

The program died on the second disk and
could not be review.

If the manufacturer has an excuse for this behavior, it may be that we were using an AT compatible that was not compatible enough. Since the same machine functioned well with all the other programs, and since about 60 percent of PCs now sold are compatibles, we would regard

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■ BACKUP SOFTWARE

such an explanation as unconvincing. The DSBackun Plus distribution disk

also includes a rather unusual addition: a demo backup program that can be copied and distributed free-and legally. The you want; you'd need to pay only if the

demo contains all the backup features of Speedbak but none of its restoring abilities. The idea is intriguing. With the free program you could make backups as long as

worst befell your system and you needed to make a restoration. We would applaud this strategy-if you could depend on the program's backups.

Fastback

Fastback was one of the eve-openers; it beloed point out the deficiencies not only in DOS BACKUP but in the IBM PC hardware itself. With this \$179 program, Fifth Generation Systems Inc. pioneered the idea of a faster, safer, and easier-to-use alternative to the DOS program. The latest release of Fastback has advanced far beyond its first realization. No longer copy protected, the program can be installed quickly and easily on a hard disk through a query procedure that sets the program's defaults, checks out the host system, and matches the program to it to ensure optimum operation. Compared with other backup systems now available, however, Fastback looks austere. Its simplicity never rises to elegance.

The moderately expensive package includes three programs for three separate functions-backup, restoration, and installation. The primary program itself, Fastback, uses a query structure and lacks many of the options in other backup systems. It will, however, search subdirectories and select files by archive bit.

The program can be operated in two modes: query and batch. Normally, after you type the program name, it responds by asking several questions about how you want the ensuing backup handled-the de-



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· POWERFUL. New squeeze option provides advanced data compression for up to 40% more data on each disk. . EASY, DS BACKUP+ is completely menu or command-line driven, with all functions simple to follow during step-by-step backup/ restore procedures.

Finally, at \$79.95, it's not only the most helpful but the most costefficient utility of its kind. Order from your software dealer, or direct from

1275 W. Roosevelt · West Chicago, IL 60185

DESIGN





909 Electric Ave., #308 Seal Beach, CA 90740 (800) 228-6127 List Price: \$179 Requires: 128K RAM.

In Short: One of the first backup utilities, Fastback has not aged well. Although it's effective, at pules in comparison with today's feature-laden utilities. Not copy protected. 620 UN READER SERV

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CIRCLE 192 ON READER SERVICE CARD

■ BACKUP SOFTWARE

vices to use, the directory to start at, the files to include (widecards permissed) and whether to search subdirectories. As soon as you have answered all of the question the program starts backing up. Batch mode requires answering the same question allows doing so on the command line, so the wide start of the start of the start of the start of the batch file. Because all the same questions must be answered in the correct of the total batch file. Because all the same questions must be answered in the correct orbatch mode saves no typing when used at the DOS prompt.

Fastback uses its own disk format (which DOS can tread) and automation formats disks as it goes along. No separate utility is provided for formatting dish for fore use. According to the documentation, formatting alone and formatting income making a backup require the same time, so soy you might as well back up as you format That explanation may make some kind of sense in an obscure logic system. That senses in an obscure logic system, the

In addition to using its own disk format, Fastback achieves its speed by operating two DMA (direct memory access) channels simultaneously and keeping the floppy disk spinning constantly—even while you exchange disks.

During the backup, a menulike screen continuously posts backup progress, listing the files that have been handled, the total elapsed time (accurately), the amount of time devoted to disk changes, and a speed factor that represents backup efficiency. The Biglie backup achieved 100 percent efficiency; that for the Scatter environments score of only Spercent.

Fasthack provides two opportunities for verifying backing up and verification while backing up and verification while storing. The documentation advises against the former because of the time penalty it imposes. We, however, recommend using the verify-while backing-up option, because we were unable to restore one of our Biglie backup attempts. The program informed us that too many errors had been concuntered. A later ty was successful.

Although once a leader, Fastback has little to recommend it in today's tougher market. Compared with its competition, the program is Spartan indeed; neither its performance nor its features justifies its premium price.

Intelligent-Backup

An outgrowth of a mainframe disk-management program and once called Data Management System for Personal Computers (or DMS/PC) by its publisher, Sterling Software. Intelligent-Backup combines a menu-driven DOS interface with backup and restoration utilities. Based on standard DOS files and structures. Intelligent-Backup takes the system approach to backup. For \$149.95, it gives you everything you need to make a complete, regularly used backup system, including disk labels and exact instructions on how often to back up each file. In addition, you can forgo the advanced system interface and use the program as a command-driven backup utility from the DOS prompt or from within a batch file.

The Intelligent-Backup system relies on tritual rather than speed. Follow the instructions, and you'll be completely prepared for any disaster—and probably breed stiff. The program actually required 50 percent more time than DOS to back up Biglie and took more than twice as long to restore it. Moreover, when it came to the Scatter disk environment, Intelligent-Backup played dumb and refused to do anything about

backing it up.

The system used by Intelligent-Backup is unusual in that it divides files into three categories: altered files, new files, and old files. Altered files are those that have changed since the last backup—that is, they have their DOS archive bit set. New files are those that haven't changed today

FILE

but have in the last 45 days for some other user-definable period) as indicated by their DOS time stamps. Old files haven't. DOS time stamps. Old files haven't changed in living memory. The three-tier approach should, in theory, cut down the program's speed penalty, because you can choose from three backup modes—update of lies only, updated files and new files consolidated, and full disk—to select the one that best files your needs. The first two selections back up fewer files and hence take less time.

To help you set up a backup system, Stering Software includes about 50 labels for tagging your backup disks. The program itself keeps a log of your backup astem properly, you can keep track of which files backed up on which disk. Individual files, blocks of files, and whole disks can be restored. If you wan, the system will also automatically remind you to make a backup each day.

Intelligent-Backup can use any DOSdisk-type device, including floppy tape (tape drives that use a disk controller), cartridge hard disks, and Corvus network virusal disks. Media must be formatted before use. To crowd more data onto every back-

use. To crowd more data onto every backup disk, Intelligent-Backup uses both data compression and file compaction, but these features saved nothing on a backup of Bigfile.

As might be expected from a program written by a mainframe software company, Intelligent-Backup is huge—256k bytes, not including necessary auxiliary files. It is so big, in fact, that Sterling Software uses the unusual strategy of compressing files on the distribution disk with an ARC utility like that used in many bulletin board systems. The program is also packed with extra features, such as its own built-in editor.

If you need or want the regimen of a system, *Intelligent-Backup* may be the program for you. It will help you get organized and stay that way.



FACT

Pdisk

Phoenix Technologies' Pdisk is a set of directory-oriented file utilities linked by a menu-driven control program. The utilities—which include backup, restore, copy, delete, and directory removal programs that can handle multiple files and search subdirectories-can also be used individually in a command-driven mode. The whole set goes for \$145.

The Pdisk backup utility is completely DOS-oriented; it puts ordinary DOS files onto preformatted DOS disks. Back up a program with Pdisk and you can probably run it right off the floppy disk. Although Pdisk will break files between disks in its attempt to squeeze as much data as possible onto each disk, command options let you keep all files whole if you want.

As a DOS-oriented backup program, Pdisk is relatively quick-about twice as fast as DOS BACKUP itself. In addition. it scored high on reliability during testing. detecting a bad floppy disk during the backup process and refusing to use it. While it did waste an entire floppy disk for the sake of a few bad sectors, we prefer this conservative approach over ignoring disk errors entirely.

The biggest problem we encountered with Pdisk was its inability to handle the Scatter hard disk environment. The program diligently searched through all files in all subdirectories and reported the total but then refused to do anything about backing them up, ending with a "File Access Error" message.

The greatest strength of Pdisk is versatility. Each program has an almost mindboggling array of options, including all the standards: date selection, archive hit selection, and subdirectory searches. The documentation requires the full, IBM-size





Norwood, MA 02062 Lia Price: \$145 Requires: 128K RAM, In Short: A set of directory-oriented utiliti

that includes backup and restore features The backup function is compatible with DOS-formatted disks but would not handle our Scatter environment. Not copy protected CIRCLE 414 ON READER SERVICE CARL

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binder. Both the backup and restore functions give you intimate control over program operation.

As an added bonus, the package includes tree-oriented disk utilities. One,

called Move relocates files and entire dia 1 rectory trees from one directory to another with a single command. (Move only changes directory entries; it does not copy the contents of a file. Consequently, the

help of a unique mechanical system (patent

pending) to let you snap a secondary card

into the same place as the first card. In

The piggy-back imitations merely sand-

In two previous columns, we have

move of a directory tree is much faster and easier than copying everything from one directory to another.) Another, Treecpy, copies an entire directory hierarchy and all the files it contains between disks and di-

Dr. Dr. Zucker 'Cures'

SLOT PHOBIA REACHES EPIDEMIC PROPORTIONS

Sunnyvale, CA, April 1987



short the Zuckerboard cure truly makes In California, we are long boards of two short boards sensitive to wine snobs who favor the more exwich two boards into the slot. This results in pensive French wines to slot overlan. Even if this could be avoided. domestic wines, even though California wines piggy-back boards never are the full funcare often superior in tion equivalent of long boards quality and price.

A similar situation exists with add-on hoards. What do foreign-made hoards have over U.S. made boards from companies like ATD makers of Zuckerboards? Nothing!

Foreign manufacturers are good at imitation. Anyone can do that, Americans are adept at quality, reliability, fast delivery, low prices and, most important, innovation. My cures for "slot phobia" are examples of such innovation.

My cures allow you, the buyer (and not the profit-hungry manufacturer), to decide what board functions you pay for

My cures, simply put, let you mix and match two full function half cards that snap together to make a long card, which does the work of two full function cards, but only occupies one slot.

I've had a flood of mail on these innovative new products. Most have been positive. A few skeptics have said this concept isn't new, and have asked, "Haven't so-called piggy-back boards been around a long time?" This kind of question misses the point.

The cure for slot phobia is not a piggyback handage others have placed on the problem, but a cure. The Zuckerboard cure uses a Zucker "bus," extended off the backend of the primary card with the

Note: Dr. Dr. Zucker (Matt Zuckerman, PhD) is President of ATD Inc. of Sunnyvale, CA 235 Santa Ana Court,

408-720-1942. ADVERTISEMENT CIRCLE 106 ON READER SERVICE CARD

enhanced graphics.



• Corefast

Unexpectedly, one program stands out among the backup utilities tested here-Core International's Corefast. This program has more features than any of the others. It includes both a high-speed and a DOS-compatible mode. It will back up to and from any DOS device and will even make an image backup of a floopy disk in about 15 seconds!

Although other programs backed up files faster, Corefast was fast enough to get the job doneand, unlike some others, it easily restored what it backed up. Moreover, it handled both the Riofile and Scatter environments without a hitch.

the program's error-correcting abilities, however. Among the packages we tested, we'd feel safest us-

discussed the first two "cures" for slot phobia. The first product, "The First Cure," uses a primary board for the AT or compatibles with either 1 meg of EMS or ex-We were the most impressed by tended memory or 0.5 megs and 128K of conventional memory, plus secondary boards to pack-up to 9 megs in a single slot in easy-to-take doseages of one, two, four or ing Corefast. eight megs. The "Second Cure" uses a primary board for the PC/AT or XT with up to two serial and one parallel port, plus secondary boards to activate a video port with color, monochrome graphics or

Like all Zuckerboards, these products are priced about half the price of more familiar brands. In addition, they are U.S. made and offer unusual quality and reliability, backed by a two year warranty.

With your continued support, we can conquer the disease of slot phobia, plus other computing ills, such as the high cost of up-grading your personal computer. To all my readers, stay tuned for future

columns which will appear every other issue. Thank you for buying Zuckerboards

> Winn L. Rosch is a contributing editor of PC Magazine.

rectories. Similar utilities will erase all files in a directory tree and remove all the subdirectories in a tree.

Some options would not work as claimed, however. For instance, the subdirectory file-erasing program, Treedel, offers two choices: prompting before deleting each file or prompting once before making its entire, massive deletion. When we selected the latter to erase the entire Scatter environment, the program erased six files, then queried about two, then erased six more, and so on. Once the various bugs are eliminated, however, hard disk users may treasure Pdisk for its file utilities alone.



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Productivity

■ PC LAB NOTES: MONITORING SWITCH SETTINGS ■ MICHAEL J. MEFFORD

A SYSTEM BOARD ANALYZER

Both DOS and your applications programs monitor the status of your configuration switches. Here's a way you can check it yourself without popping the cover.

The configuration of your PC's system board switches (or of the brain tem board switches (or of the brain jumper settings on peripheral boards tell both the operating system and your applications programs just what equipment is installed. Specifically, these settings reter the cush critically important information as the presence or absence of a math coprocessor, the amount of memory on the temporary of the composition of the control of the temporary of the control of the control of the the number of disk drives. The switches on a PC or XT do not as-

ually make electrical connections between the system and the equipment lovelved. Rather, the status of the switch settings is read and stored during the BIOS POST (Power-On Self-Test) routine as a series of "on" or "of" bits. (In an AT these bits are set when you run the diagnostic disk setup program, and their memory is kept allve by a small battery that remains active even after you power down.)

On an XT, then, if switch position 2 (bit) set to "off" (")—indicating that you have no muth coprocessor—but in fact a coprocessor is installed, the switch will not that tested for the presence of a coprocessor by looking at this setting, however, or finding the bit low would switch bit sown number-crunching routines and cost you the additional power and speed your 808T would have provided. (This is actually a test of the control of the

The configuration of peripheral boards is done by immpers, little pieces of plastic with metal contacts that make a connection across exposed stilf wires. The settings of the jumpers do actually make the electrical connections that enable the ports involved. Usually, one jumper activates the port of the board and another selects the interrupt of the control of the control of the control of the port. (For example, IRQ & is used with COMI and IRQ S with COMQ.) If you have two serial ports on your machine and both were to be configured as COMI, the conflict in port addressing would prevent one or both from functioning. The same

PRODUCTIVITY INDEX

PC LAB NOTES

Monitor the status of PC and XT configuration settings on-screen.

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improve the ERRORLEVEL routine.
PC TUTOR
Construct batch files to edit path strings

and add new directory paths.

holds true for parallel ports and/or a game port. If the jumpers are improperly set, the equipment won't work.

One obvious way to check whether the switches and jumpers are properly set is to power down, extract the cover screws of your anesthetized computer, and perform exploratory surgery. A less invasive technique is to use a program I've written, called STATUS. STATUS.COM provides a quick visual presentation of your switches-and the meaning of each-without your having to touch a screwdriver or yank out peripheral cards. STATUS also displays additional information about the presence or absence of an EGA, extended/expanded memory, free memory, and DOS and BIOS versions that go beyond the switch settings themselves. The source code for STATUS is shown

in Figure I, and Figure 2 contains a BA-SIC program that will create the COM file for you if you prefer this rouse to working with assembler. The COM, ASM, and BAS files are also available for downloading by modern, without charge, from the PC Magazine Interactive Reader Service. The procedure is described in the sidebar "Downloading STATUS."

Once you have the program on your machine, simply enter

STATUS

at the DOS prompt and you will get a full report similar to that shown in Figure 3.

HOW STATUS WORKS The BIOS POST routine reads the system board switches by latching through port 61h and Status.ess

CODE SECRENT ASSUME CHICODE, ON I CODE ONG 100R

START: JMP RECINITION

■ PC LAB NOTES

then reading port 62h. The manner in which these ports are used varies from machine to machine, however. The external, serial, parallel, and game ports are also checked via a series of reads and writes.

Fortunately, STATUS doesn't have to do the actual port checking itself, since the BIOS stores its power-up results at addresses 40:10h and 40:13h. (See the sidebar "The BIOS Data Area" for a description of the rest of the BIOS storage.)
STATUS need only issue INT 11h and INT 12h to retrieve the information.

Since STATUS is programmed as a checklist, it will be easiest to combine the explanation of how STATUS works with the details of each individual report. If first shing that STATUS does is to clear the screen with the color at the current cursor position. This is done by first reading the attribute/character at the current cursor position via INT 10h function 8. The active

The first thing that STATUS does is to clear the screen with the color at the current cursor position.

page is then scrolled with that attribute via NIT 10 flunction 6. An easier way yo clear the screen would be to call function 0 (see the screen would be to call function 0 (fill the screen with blanks with an attribute of white on black. The little extra trouble in clearing the screen with the current color startibute, however, will please those who have customized color screens. Further, clearing the screen and writing from top to bottom instead of scrolling the text on the screen makes for a better presentation.

The presentation itself begins by printing the title lines on the screen via DOS INT 9 (Print String). Placement of all text strings is controlled by another INT 10h call, this time function 2 (Set Cursor Position). Next comes a graphic presentation of the switch settings. A box is drawn us-

DATA AREA COPYRIGHT PROGRAMME 'Copyright 1987 Tiff-Davis Publishing Co.', LAN 'Richael J. Mefford' SWITCH on 179, ' O 1 2 3 4 5 6 7 6 ',179, '8' '1 ',179,' N S' DATE OF THE PLACE Clear the screen by changing to 68X25 color. Start with graphic display of the switches. Print switch explanation. RECINNING NOV XOR IRT NOV AR,6 EE,BE ;Get attribute at corsor. Page sero. 16R DR, AE fintire screen. rRP will be used for cursor r position. Display heading r st row 0, col 22 (168). DE, OFFERT PEADING MOV RP. 1238 pRow 1, col 35. Print "Switches". ROV DE, OPPSET SMITCHES RP, 21DH LOCATE DL, 21 B FRIRT_CHAR FRIRT_LIRE |Row 2, col 29. Olioplay switch box sterting y with upper left corner, yPrint the line. yUpper right corner. CALL HOV DL, 191 FRINT_CHAR RP, 31DH OK, OFFSET SWITCH1 LOCATE_STRING EP, 41ER ;Row 3, col 29. ;More of switch displey. |Row 4, col 27. DX, OFFSET SWITCH 2 LOCATE_STRING | Npace = 8 hlock = 1. |Display on position first. DC.179 :Finish box on line 4. PRIRT_CHAM RP,518H DX,OFFSET BWI LOCATE_STRING EX,ROGZER Now 5, col 27, Hore of switch display. ;Switch graphic charecters. Display ell # switch settings. pointley ell 8 meitch settings fuguipment determination. Here in DB. ;Assums one of the char. ;Is hit en? ;If yes, display graphic char. ;Et as, gat other char. ;Print the char. ;Print the char. DOT_IT DL.EL PRINT_CHAR one re-DL,32 PRINT_CHAR DB, 1 HEXT_SWITCH SWITCH_PLAG SWITCH_PLAG, 2 Rotate one to get next bit. ; How check for off hit mettinge. ; How check for off hit mettinge. ; Have we done it already? ; II no, do it now. DL,179 PRINT_CHAR RP,61DH LOCATE DL,192 PRINT_CHAR PRINT_LIRE DL,217 Pinish line 5. ;Row 6, col 29. Rottom left of box. Display the line. PRIRT_CHAR ---

* REMEMBER TO EXECUTE

ing the high ASCII graphic character set. Figure 1: The Assembler listing for STATUS.COM.

CALL PRINT_STRING

, Mark with saturisk the correct switch setting.

BX, AX BP, 6028 DL, '*' DISPLAY_BIT1 BP, 1005 DIRPLAT_BITL:

BF, 1888 LOCATE_CHAN BF, 86828 BX,2 DISFLAY_BIT2 BF, 1888 LOCATE_CHAN MOV TEST DIRPLAY_BIT2:

RP,1202R RP, SR27R RITS CALL

Pause and check if EGA is present.

AX. PC###D DS, AX S1,1EM DI, DPPGET IBM DX, DPPSET BGA CX,3 MOV MOV MOV MOV REPS FUSR FOS CHESE

DS FINISR_RITE DP,19 LOCATE_STRING De 18279

PINISH_RITS:

CK_COM1:

BITS ; Display the number of perallel ports.

PRINTERS pr. 14018 BP,1401B 1DCATE 11R DC,'6' AM,1000000B CM_PER1 DC,2 AM,1000000B

TEST CH_PRH1: PRINT PAN DL PRINT_CHAN DX,DPPSET PARALLEL PRINT_STRIME PRINT_PANI

Display the number of serial ports, ; SERIAL PORT:

BP. 15018 LOCATE 11R DL,'8' AN,1898 CK_COM1 AR, 10R

CALL PRINT_CHAR DX,DPFSST SERIAL PRINT_STRING PRINT CON-CALL

Display if game port is on board.

BP, 16018 CALL INT NOV LOCATE 11B DL, 'B' AN, 100000 PHN_GAME

PRN_GARE: DE, DPPSET GAMEFORT PRINT STRING | Equipment determination. | AK will be used so store in EX. | Passums row 8, col 2: | Park with saterisk. | Is bit one off? | If yes, we assumed right. | Ilse, goot row 9.

;Assume row 11, col 2. ;Is bit two off? ;If yes, ws mesumed right. ;Else, goto row 12.

;Row 18, col 2. ;Mark the other hits. :Row 11, col 39.

IDGA DIDE segment. ; IRR signature offset. :Assume DGA present. Compare three bytas.

; If not present, skip. ;Else, sdd 19 to column. ;And display "EGA". 180w 16, col 39,

180w 28, col 1.

Get equipment squir jest equipment squim.
jhamma sero printere.
jls bit 15 on?
jlf no, check bit 14.
jElse, sdd two to count.
jls bit 14 on?
jlf no, resedy to print.
jElse, sdd one to count.
jPrint the count.
jAdd the text.

|Row 21, col 1.

;Ratrieva equiment again. ;Ratrieva equiment again ;Aasume tero. ;Ia bit 18 on? ;If no, chack bit 9. ;Else, add two to count. ;Is bit 9 on? ;If no, ready to print. ;Ilse, add one to count. ;Print the count. ;Add the text.

|Row 22, col 1. ;Retrieve equipment.

(Figure 1 continues)

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Next, an explanation of the bit settings is displayed, and the current settings of the machine are marked with an asterisk. For

■ The low half of the equipment word has the bit settings for the switches, whether for the hardware switch of the XT/PC or the software switch of the AT.

example, if you have two disk drives and, appropriately, bit 7 is off and bit 8 is on, then an asterisk will appear as follows:

Bits 7-8 no. of disks 11 = 4 10 = 3 01 = 2 00 = 1

Incidentally, STATUS numbers the bits starting at 1 instead of 0. Also, the switch reads from left to right, that is, from 1 to 8 instead of from 7 to 0 (this latter is the usual convention for reading a binary number). This is for better readability and to follow the convention found in IBM's Guide to Operations.

Unless you're the only known person ever to use a cassette tape recorder for I/O, bit 1 should always be on. Bit 2, as men-

Display total system memory. TOTAL MEMORY. ;Row 18, col 38. ;Diepley text. RP,1226R)Ratrieve total memory. ;Display via division routine. NO CARRY IL, 'E' PRINT CHAR Display the bytes free for programs. SYTES PASS |Row 19, col 3E. Get free memory. Displey extended memory. SF. 1 4268 |Row 28, col 38. DS AX,EPERES Seve date segment. 5 : [KPPPRH] Retrieve ID byte. ; Ie it AT cless mechine? ; If no, no extended memory. ;Get no. of if blocke ; of extended memory. :Else, displey E bytee. NO EXTEND. DX, OFFEET NONE PRINT_STRING ; If no extended memory, display "None". eplay expanded memory. ;row 21, col 38. DE, DPFERT EXP LOCATE_STRING AX,3567R 21R |Get INT 67R vector. |Point to "KRM". |Point to Device name. |Compare three charecters. |Restore ES. ; If name not there, no expanded ; Else, get number of 16K blocke skultiply by 16 to get 18 blocke. Display via division routine. ; If no expanded we ; display "Rone". Display DOS version. OS_VERSIDM: :Row 22, col 38, one our version. ;Save minor vergion no. In SL, ;Iero in high half. ;Convert major vergion number ; to ASCII end print. Dieplay the minor number.

Display HIDS version and search for copyright.

(Figure I comting

BIOS_VERSIOS:	HOV CALL	SP,1726B OK, OPPSET BIOS LOCATE STRING	;Row 23, col 38.
	HOV	AX, 070008	;Point to SCS segment.
	HOV		Point to Data Elight characters max.
	CALL	CX.8	; and display.
	CALL	BP,1826B LOCATE	Row 24, coi 38.
	MOV	DE,OPPEST COPTS	Point to "Copyright"
	CALL	BP, 9 SEARCH	Bine characters.
	JBC MOV	DISPLET_MATCH DE,OFFSET CAP_COPS	; If no carry, got match. ; Point to *COPR.*
	HOV CALL JHC	BF,5 SEARCH DISPLET_MATCH	; Noint to "COPK."
	WOV	DE-OFFRET LOWER COPS	Point to "Copr."
	CALL	BP,5 SEARCH	rand search.
	JHC	DISPLAY_MATCH	
	MOV CALL	DE, OPPSST CAP_C SP, 3 SEARCH	Point to *(C)*
	JBC	SEARCH OLSPLAY_MATCH	shad search.
	HOV	OX, OFFSET LOWER_C	Point to *(e)*
	CALL	BEARCH	, And search.
OISPLAY, NATCH:	JC 1938	EXIT DE	;And search. ;If didn't find it, give up. ;Sava Copyright segment.
	POSE	CI DE	
	HOV	DX.OPPRET CAP_C	pPrint (C).
	POP		Rastora Copyright segment.
	CALL	CX,38 ASCII	and display.
EXIT:	CALL	BP,1788B LOCATE	pRow 23, coi 8.
	INT	28H	;Row 23, coi #. ;Terminate.
	INT	BP,17888 LOCATE 28H FT1888	
,	CALL INT SUBJICE	28H	;Terminate.
; This subrout	CALL INT SUBJICE Ine sea	TISSS ****** ITISSS ****** ITISSS ****** ITISSS ******	rerminate.
; this subjout	SUBJICE SUBJICE Ine sea MOV MOV	INCLUDE 28H PERSON FOR FOR STATE STA	rerminate.
; This subrout	CALL INT SUBJECT INC SOS HOV HOV HOV REPT	INCLUDE 28H PTINSS ****** In these through BOW for BX, 8 CT, 8P S1, 8X CR, CR	preminate. the copyright; jStart et offset zero. jStartieve starting offset, jStartieve starting offset, jOt has offset of test to match
; This subrout	CALL INT SUBJECT INC SOL HOV HOV HOV SIPI JI	INCAME 228H PTIMES ****** arches through MOM for EX.8 EX.80 CX.8P 81.8X CX.9B RATCH RATCH	preminate. the copyright; jStart et offset zero. jStartieve starting offset, jStartieve starting offset, jOt has offset of test to match
; This subrout	CALL INT SUBSICE INC MOV MOV MOV MOV MOV MOV MOV MOV MOV MOV	LOCATE 28H PTISSS ***** Firehes through MON for BX,8 CI,8P CI,8X OI,0X CKPRB MATCH	preminate. the copyright; jStart et offset zero. jStartieve starting offset, jStartieve starting offset, jOt has offset of test to match
; This subrout ; This subrout search; HEXT_SEARCH;	CALL INT SUBJECT INC SUBJECT MOV MOV MOV REPI JI STC JNE SET	INCAME 228H PTIMES ****** arches through MOM for EX.8 EX.80 CX.8P 81.8X CX.9B RATCH RATCH	preminate. She copyright.; Short at offest are. Shallow side fact are. Shallow side for the are. Iff has offest of test to match Iff are, we get a match. Iff has to sure, we are done indicate no match with care.
; This subrout	CALL INT SUBJOX ine sea MOV MOV MOV MOV MOV MOV JI INC JNI STC	INCAME 228H PTIMES ****** arches through MOM for EX.8 EX.80 CX.8P 81.8X CX.9B RATCH RATCH	preminate. She copyright.; Short at offest are. Shallow side fact are. Shallow side for the are. Iff has offest of test to match Iff are, we get a match. Iff has to sure, we are done indicate no match with care.
, This subrout , This subrout , This subrout , This subrout , This subrout , This subrout , This subrout	CALL INT SUBSECT ROW MOV	INCAME 228H PTIMES ****** arches through MOM for EX.8 EX.80 CX.8P 81.8X CX.9B RATCH RATCH	preminate. The copyright. T
; This subrout ETARCH: MATCH: This subrout This subrout	CALL INT SUBJECT SUBJE	LOCATE THE STATE OF THE STATE O	prerinate. previous to copyright. previous copyright.
, This subrout, RATCH;	CALL INT SUB-MOV NOV MOV MOV MOV MOV MOV MOV MOV MOV MOV M	LOCATE THE STATE OF THE STATE O	prerinate. previous to copyright. previous copyright.
, This subrout, RATCH;	CALL INT SUB-MOV NOV MOV MOV MOV MOV MOV MOV MOV MOV MOV M	TIMES TIMES TIMES Extra schee through now for the character of the control of	president. The copyright, the copyright, the copyright, the copyright, the copyright
, This subrout, RATCH;	CALL INT SUB-MOV NOV MOV MOV MOV MOV MOV MOV MOV MOV MOV M	TIMES TIMES TIMES Extra schee through now for the character of the control of	preminate. The copyright. There is offest asto. Thusber of the sacto. Tiles point onest offest. Tiles point onest offest. Tiles one to sact offest. Tiles one to sacto. Tiles onest offest.
, This subrout	CALL INT SUB-MOV NOV MOV MOV MOV MOV MOV MOV MOV MOV MOV M	LOCATE THE STATE OF THE STATE O	president. The copyright, the copyright, the copyright, the copyright, the copyright
; This subrect SEARCH; REXT_SEARCH; NATCH; This subrect ASCII; ENG_ASCII;	EALL INT SUBBOX INE SEE SOV MOV MOV MOV MOV MOV MOV MOV MOV MOV M	Light Market brough Ros for Early Parket Brist B	president. Jest to effort same, president of same,
; This subrect SEARCH; REXT_SEARCH; NATCH; This subrect ASCII; ENG_ASCII;	EALL INT SUBBOX INE SEE SOV MOV MOV MOV MOV MOV MOV MOV MOV MOV M	LOCATE TITLES BL. CL. P.	president. Jest to effort same, president of same,
; This subrout EEAACH; RATCH; ; This subrout AGCI; EEQ_AGCI; This subrout	CALL INT SUBSICION INE SEU SEV	Lower Lo	president. pleast a offest same. pleast a offest same. pleast a offest same. pleast of the same. pleast of th
, This subrout EEACH MATCH MATCH THIS SUBBOOK MATCH MATCH THIS SUBBOOK MACLI THIS SUBBOOK TH	CALL INT SUBSICE INE SEE SUBSICE INE SEE SUBSICE INE SEE SUBSICE INE SUBSICE I	Light State Bigs Bigs	presidents process of the section o



MARC ADLER **NEW YORK WORD**

Marc Adler, author of New York Word, took his Bachelors degree in Computer Science from State University of New York at Albany. He received his Masters degree, in Computer Science, from the University of Arizona. He pursued his Ph.D at the Kourant Institute of Mathematics at N Y.U. before he determined it was hopeless. His word processing program is an easy to use, powerful, text editing and formatting tool in fact, it contains many teatures

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■ PC LAB NOTES

tioned above, is on if the coprocessor is installed. Bits 3 and 4 are for the system board memory, the interpretations having different meanings depending on the machine. (According to the AT's Tech Ref, these two bits are not used by the AT'.) Bits 5 and 6 indicate the initial video mode, and 7 and 8 are for the number of drives.

After the initial video mode is marked with an asterisk corresponding to the bit settings, STATUS checks to see if an EGA (enhanced graphics adapter) is installed. The IBM EGA BIOS (and that of almost all clone boards) has a "signature" (the letters "IBM") at CO00.001E. If STATUS finds this signature, it adds the chartes: "IGAD" in its video mode report.

PORTS The high half of the word retrieved from INT 11h contains the information about the number of printer (paral-

■ After the initial video mode is marked with an asterisk corresponding to the bit settings, STATUS checks to see if an EGA is installed.

lel) ports, serial ports, and a game port. The same TESTing method used to determine the switch settings is used to calculate the number of existing active ports. The top two bits, 14 and 15, are for the parallel ports. (From here on, since we don't have to be concerned with switch positions numbered from 1 to 8, I'll revert to the conventional "bit" numbering: bit 15, not 16, is the highest bit in the word.) Bit 13 is not used. Bit 12 is on if a game adapter is present. Bits 11, 10, and 9 are for the serial ports. Bit 8 is not used. Note that with the three serial port bits, a number as large as 7 can be represented. However, there are only four reserved word memory locations (starting at 40:00h) to store the addresses

	WOW	AX, BB	
	MOV	DX. DX CX. 64	(Divide by 64 to get memory
	DIV	CX.**	; in X bytes.
	CHP	tx,32	, an a sycan.
	28	NO CARRY	
	INC	AX	(Round up if half or abova.
HO_CARRY:	MOV	BX, AX	
	HOV	DISPLAY_PLAG, 0 CX,10000	pReset display flag. pGet ten thousands by divid
			lest tan thousands by divid
	MOV	CX.1000	(Get thousands by dividing,
	CALL	DIVIDS	
	CALL	CX,188 DIVIDE	Get hundreds by dividing.
TERRI	MOV	CX.10	plet tens by dividing.
	CALL	DIVIDE	
	CALL	CX,1	gast ones by dividing.
	RET	DIVIDE	
DIVIDE:	MON	AX. BX	:Number in AX
	XXX	DX DX	, and sare in DR
	DIV		; divide by CX ; remainder into BB
	MOV	BB, DX	remainder into 33
	CRP	DL, AL	sand quotient into DL.
	72	PLAG	Its it raro?
	DR	DISPLAY_PLAG, AL	; if yes, is a non-zero disp ; if non-zero, indicate by i ; Non-zero no. been displays
PLAG:	CMP	DISPLAY_PLAG, 0	Non-maro no. been displays
	JA RET	DISPLAY	If yes, display size rature to suppress leading seros
DISPLAY	CALL	DL,38E PRINT_CHAR	Convert hesidscimal to decimal and display.
	FET	NATIVE CHAR) to decimal and display.
,			
These are th	MOV INT	DOS display subrout: AM,9 218	men. I
PRINT_STRING:	MOV INT RET	AH.,9 21.8	print string.
These are th	MOV INT RET	AH.,9 21 H	nes.
PRINT_STRING:	MOV INT RET	AH.,9 21.8	print string.
These are the PRINT_STRING: PRINT_CHAR: 1 These two su	MOV INT RET MOV INT RET	AR, 2 21R AR, 2 21R	print string.
These are the PRINT_STRING: PRINT_CHAR: 1 These two su	MOV INT RET MOV INT RET	AM, 9 218 AB, 2 21R AB, 1 Contacts the curso LOCATE PRINT_STRING	print atting. ¡Print atting. ¡Display output.
These are the print_STRING: print_Char; print_Char; these two so	MOV 18T RET MOV 18T RET ACOUNTING	AR,9 21R AR,2 21R nes locats the curso:	print atting. ¡Print atting. ¡Display output.
These two su	MOV 18T RET RET LINT RET CALL CALL RET CALL RET	AM. 5 21.8 AM. 2 21.8 THE AMERICAN AMER	print string. print string. plaplay output. before displaying wis EDS.
These are the PRINT_STRING: PRINT_CHAR; These two so LOCATE_STRING:	MOV INT RET MOV INT RET Arouti CALL CALL RET Ine se	AN.5 218 AN.2 AN.2 AN.2 AN.2 AN.2 AN.2 AN.2 AN.2	print string. print string. plaplay output. before displaying wis EDS.
These are the PRINT_CRAR; PRINT_CRAR; These two su LOCATE_CRAR; This subrout	MOV INT RET RET RET CALL CALL RET CALL RET CALL RET CALL RET	AM. 5 218 AM. 2 218 AM. 2 218 LOCATE PRINT, CHAR LOCATE PRINTT, CHAR LOCATE PRINTT, CHAR LOCATE PRIN	print acting- pr
These are the PRINT_CRAR; PRINT_CRAR; These two su LOCATE_CRAR; This subrout	MOV INT RET WOV INT RET CALL CALL RET CALL RET FOSH POSH POSH POSH	AM, 5 218 AM, 2 218 AM, 3 218 AM, 5 218	print action, pr
These are the PRINT_CRAR; PRINT_CRAR; These two su LOCATE_CRAR; This subrout	MOV INT RET RET RET RET CALL CALL RET CALL RET POSH PUSH PUSH PUSH NOV XOOR	AM, 5 218 ac, 2 218 cost locate the cursor LOCATE FRINT_CLAM to the cursor position to the	print action. print action. print action. print action. print action via 100. print action. print ac
These are the PRINT_CRAR; PRINT_CRAR; These two su LOCATE_CRAR; This subrout	MOV INT RET MOV INT RET CALL CALL RET CALL RET CALL RET PUSH PUSH NOW MOVE TO THE PUSH NOW MO	AM, 5 218 AM, 2 218 AM, 3 218 AM, 5 218	print action, pr

of the ports, and only three are currently supported. The same logic (or lack of it) applies to the parallel ports. The four storage addresses start at 40:08h, and only three are supported.

CONVENTIONAL MEMORY Main memory, i.e., the memory found on the system board, is a simple matter to retrieve via BIOS interrupt 12h. This short BIOS routine returns with the number of IK contiguous blocks in AX. This value can also

be found directly by reading the BIOS data area, 40:13h. The BIOS determines this value on power-up by reading ports 60h through 62h.

(Figure 1 continues

The number returned is in bex kilobytes. STATUS converts this to decimal by successively dividing by 10,000, 1,000, 100, 10, and 1. If the division results in zero, STATUS does not show it unless a significant number (something other than zero) has already been displayed. This method suppresses confusing



and meaningless leading zeros.

This same division routine is used to display bytes free, the decimal portion of the DOS version, and, if it exists, extended or expanded memory.

version d version

BYTES FREE Bytes free consists of conventional memory, less what is used by the operating system (DOS), the resident portion of COMMAND.COM, and any resident programs. This figure indicates the amount of RAM available to applica-

tions programs. Any extended or expanded memory is not included in the byte

(Figure 1 ends)

count of bytes free. Normally, when a program is loaded, DOS allocates all the available memory to the program. To determine the bytes free, STATUS first returns all memory allocated to it back to the system pool. This is done via INT 21 function 4An (Modify Allocated Memory Blocks) with BX = 0. This frees up all memory including what is presently being used by STATUS. Then



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PC MAGAZINE
August, 1986
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■ PC LAB NOTES

THE BIOS DATA AREA

For those of you who do not have a Technical Reference manual, Figure A presents a listing and brief description of the other bytes in the BIOS data area. STATUS uses only the words at offset of 10H and 13H. An interesting way to watch the data area in motion is to moni-

Figure A: Other bytes of interest in the BIOS data area than the 10h and 13h used by STATUS.COM.

tor the changes in the keyboard status flag or the timer storage words. To do this, load DEBUG and enter

R DS DS XXXX

:40

This will change the data segment to 40H. Then it's easy to look at any of the data areas with the dump command. For example, if you enter

D 17 L 1 DEBUG will display the first byte of the keyboard status. Then change the caps

state by pressing CapsLock and enter the same dump command again. The byte will change the value depending on the other shift states. Experiment with the other Shift keys-for example, enter the dump command while you are depressing one and/or both Shift keys.

The other word that will change rapidly is the timer. Just enter the following several times in succession:

D 60 L 2

When you're through, to exit DEBUG. enter Q .- Michael J. Mefford

Bytes in the BIOS Data Area				41H	Byte	Disk status. Bit settings code type of disk error.	
Seg	ment 4	юн				Bit 7. Time-out failure	Bit 3. DMA overnin
Offset	***	Description				6 Seek tailure	2 Sector not lound
						5 Controller failure	1 Write protected
0H	4 words	Addresses of up to four se				4 CRC tailure	0 Address not tound
6H	4 words	Addresses of up to four pa					
10H	Word	Equipment: Low byte carries switch information. High byte (11H) has number of ports (serial, etc.). (Used by STATUS.)		42H 49H	7 bytes Byte	NEC status. Current CRT (video) mod	le.
12H	Byte	Manufacturer test liags.				Bet	Bit
13H	Word	System board or main me (Used by STATUS.)	mary in K bytes.			7 Monochrome 3 80 × 25 color 6 640 × 200 8W 2 80 × 25 BW 5 320 × 200 8W 1 40 × 25 color	
15H	Word	Expansion RAM in K bytes				4 320 × 200 color	0 40 × 25 BW
17H	Byte	Current shiff status. If bit					
	. ,			4AH	Word	Current number of colun	ns on the screen.
		Bit 7 Insert topoled	Bit 3. Alt decressed	4CH	Word	Size of the video buffer.	
		6 CansLock topoled	2 Ctrl decressed	4EH	Word	Starting offset of the vid	- Later
		5 NumLock toggled 4 ScrollLock toggled	1 Left Shift depressed 0 Right Shift depressed	50H	8 words		or each of eight pages, starting
				60H	Word	Starting and ending line	of cursor
16H	Byte	Second byte of keyboard status. If bit is on, indicates:		62H	Byte	Current active display or	
		Bit 7 Insert depressed 6 CansLock depressed	Bit 3 Ctrl-NumLock toggled 2 PCir Clicker toggled	63H	Word	Port address of active di 384 – Monochrome 3	
		5 NumLock depressed	1 PGir Att-Ctrl-Caps	65H	Byte	Current setting of the CF	T mode register.
		4 ScrollLock depressed		668	Byte	Current palette	
				67H	Word	Data edge time count.	
19H	Byte	Alt-keypad entry for ASCI	I characters.	69H	Word	CRC register.	
1AH	Word	Pointer to keyboard buffe	Pointer to keyboard buffer head.		Byte	Last input value.	
1CH	Word	Pointer to keyboard buffe	r tail.	6CH	Word	Low half of timer.	
1EH	16 bytes	Keyboard buffer.		6EH	Word	High half of timer.	
3EH	Byte		ext seek will recalibrate by	70H	Byte	Timer overflow. One if bi	
		repositioning to track 0.		71H	Byte	Bit 7 = 1 to indicate Bre	
		Bill 3 = Drive D 2 = Drive C	Bit 1 = Drive B 0 = Drive A	72H	Word	Resel Ilag. A warm bool word equals 1234H when	instead of a cold boof is done if this n Ctrl-Alt-Del is pressed.
		z = unve c	n = nuse v	74H	2 words	Hard disk status.	
3FH	Byte	Material Main 7 - 1	malle in accessor 18 bile	76H	4 bytes	Time-out for the parallel	ports.
orH	Dyud	Motor status, it bit 7 = 1, write in progress. It bits 3 through 0 = 0, indicates motor on. See seek status for			4 bytes	Time-out for the serial p	orts.
		bit assignments.		80H	Word	Offsel address for start of	
408	3194	Motor count for their out-	until motor turnell.	828			

DOWNLOADING STATUS

The programs that appear in our PC Lab Notes column (as well as other programs we publish) can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. You may make copies for others (including placement on noncommercial electronic bulletin boards), as long as no charge is involved. However, making copies for any commercial purpose is strictly prohibited.

The modern number for PC-IRS is (212) 696-0360. Set your modern and communications software to use 1,200 parity. PC-IRS files with a .COM, .EXE. or .ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., those with extensions of .ASM or .BAS) can be downloaded using either regular ASCII

STATUS.BAS, whether typed in from the magazine at your keyboard or downloaded from PC-IRS, will automatically create STATUS.COM when run once in BASIC, STATUS, ASM, also listed both here and on PC-IRS, allows you to modify the program but requires you to use a macro assembler (IBM or

MASM STATUS:

or Xmodem transmission.

Microsoft) and the following commands: LINK STATUS: (or 300) bps. 8 data bits, I stop bit, no EXE2BIN STATUS STATUS. COM

STATUS AT A GLANCE

Syntax:

[d:][path]STATUS

Operation: STATUS provides an onscreen display of the current systemboard configuration settings for an IBM PC or XT (or the equivalent AT equipment byte). The data reported includes the number of disk drives, presence/absence of a math coprocessor, amount of on-board system memory (not for AT), initial video mode (including EGA), amount of installed and free RAM. amount of extended and expanded

INT 21 function 48h (Allocate Memory) is issued with BX = 0FFFFh. BX is equal to the requested paragraphs of memory, one paragraph equating to 16 bytes. 0FFFFh paragraphs (1024K) is, obviously, more memory than is actually available to us. DOS, being just as smart, refuses the request and on return, politely prompts us with the amount of memory that is available. Voilà!

The amount of free memory is also returned in paragraphs. This number is converted to kilobytes by dividing by 64 (1024/64 = 16). The result is rounded up if the remainder is equal to 32 or above. (This is analogous in decimal arithmetic to rounding up if the remainder is equal to 0.5 or above.)

memory, number of parallel, serial, and game ports, and DOS and BIOS versions. Some information may not be reported by non-IBM "compatibles." EXTENDED MEMORY To determine

the amount (if any) of extended memory installed. INT 15h is issued with AH = 88h. INT 15h is the old cassette I/O. In an AT (remember that extended memory is available only in an AT-class machine) INT 15h returns with AX = number of K bytes of extended memory. (For more discussion about extended and expanded memory, see "Enlarging the Dimensions of Memory," PC Magazine, Volume 5 Number 1.) If INT 15h is issued in a machine other than an AT, unpredictable results will occur. So, before issuing INT 15h, STATUS must check to see if it is operating on an AT-class machine. This is determined by the ID byte in high ROM memory. The coding of the byte at address F000:FFFE is as follows:

FF = PC or early XT

FE = XT FD = jr

FC = AT

If FCh is found, STATUS issues INT 15h to get the available memory.

Programmers should note that the interrupts must be turned back on with an STI instruction upon return from INT 15h. Unlike other interrupts, INT 15h shirks this responsibility. Failure to enable the interrupts will let interrupts stack up, and even-

 Before issuing INT 67h, STATUS must first determine whether or not expanded memory exists by checking if the

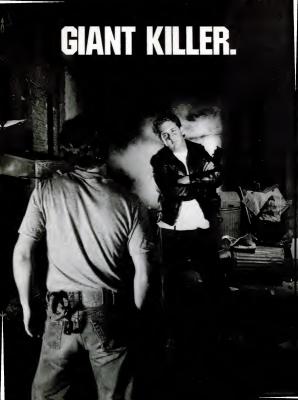
expanded memory manager is installed.

tually the program will perform that most embarrassing act of locking up the machine. The correct assembly code looks like this:

MOV AH, 88H INT 15H STI

EXPANDED MEMORY INT 67h is used by the expanded memory manager device driver. Issuing INT 67h with AH = 42h will return with a value in DX equal to the number of 16K blocks of expanded memory. If no expanded memory manager has been installed, however, the vectors for INT 67h will simply be zeros and the machine will crash. So STATUS must first determine whether or not expanded mem-

ory exists by checking if the memory manager is installed. INT 67h is a device driver with a header starting at offset 0. Unlike .COM files. which construct a PSP (program segment prefix) in the first 100h bytes, device driv-



LOTUS. HISTORY IS ABOUT TO REPEAT ITSELE

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■ PC LAB NOTES

ers use the space for a header. Eight bytes, starting at offset 0Ah, are reserved for the device name. STATUS first retrieves the vector for the manager via INT 21, function 35h (Retrieve Interrupt Vector). The interrupt is called with AL = 67h, the vector of interest. ES:BX returns with vector. The expanded memory manager has a name of EMMxxxx, so STATUS first verifies that EMM is installed by looking for the characters EMM at offset 0Ah of INT 67h. If found, the available memory can be retrieved via issuing INT 67h with AH = 42h. DX returns with the number of 16K blocks. This is multiplied by 16 to display the memory in kilobytes.

DOS VERSION Getting the DOS version is a simple matter of issuing INT 21h function 30h. On return, AL contains the major version number (the number to the

 The last thing STATUS reports is the BIOS release date and copyright. STATUS looks for the release date at address F000:FFF5.

left of the decimal point) and AH has the minor version number. If AL returns with zero, then the version is pre-2.00. (Unless you're still in the Dark Ages, you'll have upgraded at least to 2.00.)

BIOS VERSION The last thing STA-TUS reports is the BIOS release date and copyright. STATUS looks for the release date at absolute address F000:FFF5. This is the reserved memory address used by IBM. Other PC compatibles may or may not follow this convention. In any event, STATUS displays the up to 8 bytes found between the ASCII space character and the lowercase "z." As mentioned above, this is the same relative location for the ID byte. If you are adventurous, you can explore this area of memory by loading DE- Figure 2: A BASIC program that will automatically produce STATUS.COM

202, 1037, 1 312.





Figure 3: A sample on-screen STATUS report

BUG and then entering the commands:

d F888:FFF5 L8 for the release date d F888:FFF5 L1 for the ID byts

The location of the copyright is most unpredictable from BIOS to BIOS. To find a copyright notice, STATUS goes on a scavenger hunt looking for one of several key phrases. The program assumes that the BIOS authors used Copyright. COPR.

Copr., (C), or (c) as a preface to their name. If none of these phrases are found, STATUS gives up, surmising the authors wish to remain anonymous. Note that STATUS insists on a period after the two

Copr. phrases. This is to avoid getting a match on the word Coprocessor.

The search is conducted starting at the address F000:0000 and continuing to the end of ROM (F000:FFFF). Starting at ad-

dress F000:F600, 32K is reserved for Cassette Basic (subroutines used by PC 38C). In most clones, this memory is unused; that's why you have to run ofWBASIC or some other generic BASIC program. In this case, obviously, STA-TUS will not have a chance in finding a match until it gets to the BIOS routines starting at address F000:FE00. It's in this last 8K of ROM that a match is most likely to be found.

The assembly instructions to search for a string are not as complicated as you might think, thanks to the CMPSB and REP instructions. The routine STATUS uses can be found in the assembly listing at the label SEARCH. The source pointer (SI) is initialized to zero and the counter (CX) is initialized to the length of the string to be found. The destination (DI) is set to the offset of the string to be matched (COPR., for example). Then the powerful combined instruction REPZ CMPSB is executed. This instruction compares the 2 bytes pointed to by SI and DI until either they are not found to be the same or CX becomes zero. The same instruction increments SI and DI to point to the next pair of bytes in the string and, at the same time, it decrements the counter (CX).

All that needs to be done, then, is to check if CX made it to zero with a JZ instruction. If CX = 0, then STATUS branches to the subroutine to handle a match. Otherwise, the source is bumped to the next starting byte in ROM, and the compare instruction is executed again. Now that's a powerful instruction!

Before exiting, STATUS moves the cursor to line 24. Since the entire screen is used and the last place to which STATUS writes is line 25, if an exit were made without this correction, DOS would scroll the screen by issuing the carriage return-linefeed before returning the prompt.

That's it. Stick ŠTATUS in your toolbox. Give your machine a checkup. And, as with all good medical tools, it's hoped that you will not need STATUS for serious equipment problems, but if need be, it will be nice to have around for quick, painless exploration before resorting to surgery.

Michael J. Mefford is a microcomputer consultant who works out of his home in Gleneden Beach, Oregon.

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A DOS MUSIC GENERATOR



If the pitch in your office has become as sharp as a 444-Hz A, here's a utility that lets you create a more restful tempo without even going into BASIC.

T's nice occasionally to take a short break from the serious side of utilities programming. In this issue you'll learn how to musically noodle with PLAY, and next time you can graphically doodle with DRAW. After time out for some fun, you'll return to the grindstone with rested wits.

PLAY.COM emulates the BASIC command set of the same name, but frees your musical creativity from the constraints of working within BASIC. Not that you have to be a Henry Mancini to use PLAY: as a youth I played the accordion; that's my only musical (?) background.

You can save the chore of entering either the assembly language listing for PLAY (shown in Figure 1), or the BASIC program (Figure 2) that will create PLAY .COM automatically, by taking advantage of the PC Magazine interactive Reader Service. Instructions for downloading any or all of the PLAY files from the IRS by modem are given in the accompanying sidebar.

The syntax for PLAY is

PLAY [string[/K] | filsepec/F[/K]]

Don't let such a strange-locking format alarm you. It means only that you have several options when using PLAY, COM, If you give PLAY no arguments, that is, just enter PLAY, the program will automatically try to use a file called PLAY DAT in the current directory. You are responsible for creating the PLAY, DAT data file (think of it as composing a score). Incidentally, when preparing PLAY

Proy.ess Buletes Beeic's Pley commends F FLAT [string[/K] | filespec/F[/K]] /K denotes no keyboard polling PERSONNEL TO PERSONNEL THE REGINNING 'Copyright 1987 Siff-Devie Publishing Co.', LAF TIMES THE C C8 D D8 E 'PLAY.DAT'. DB Speed the clock up to four times normal speed.
Capitaliza command line and check for switch characters. Divisor for 72.8/sec IRQ 8. AX,35088 218 oGet INT 8 (timer tic). WORD PTR TIMER_TIC, BX WORD PTR TIMER_TIC[2], ES :Seve old vector. Restore ES. DX, OFFSET INT 8 Point INT # to our routine. AX, 2500B CHIP JO HOV LOD CHIP HYTE PTR DS:[60H],0 PARAMETERS Are there any parametere? CAPITALISK Point to parametere. SEXT CAP: ;Is it carriage return? ;If yes, done here. ;Is it switch character?

PROGRAMMING/UTILITIES

.DAT, note that PLAY strips the high bit, so you can use any word processor that does not include a header with the text. That includes WardStar's document mode.

The second option is to give PLAY arguments directly from the command line as a string. Using this method, you can give PLAY up to 123 commands (128 less the 5 for PLAY and a space). Note: when you do this, omit the quotes that BASIC demands. Here's an example of a short command line entry:

PLAY T15002L6G03CEL8G.EL2G

Note above the difference in the number θ used in setting tempo, and the letter O,

which denotes the octave.

Another way you might use the immediate mode of PLAY is to create different frequency and length beeps to use as prompts in a batch file. For example, try

PLAY T255L64GAGAGAGAGAGAGA

Or, if you want to just hear all 12 notes of the scale in one octave, enter

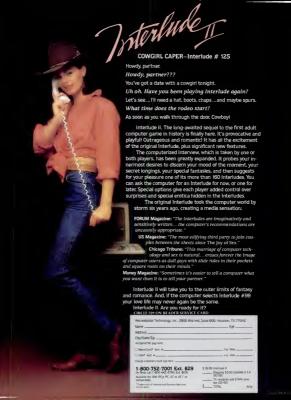
PLAY C CO D DO E F FO G GO A AO B

Notice that in this example I placed spaces between the notes for better readability. You can also use commas or semicolons for delimiters that won't affect the actual music.

Your third option is to give PLAV a can use any legal DOS filespee, including any legal DOS filespee, including another. The filespee is the filespee in the filespee is the filespee in the f

As a working example, Figure 3 contains a data file for the Scott Joplin rag
"The Entertainer," best known as the
theme music for the movie *The Sting*, as
well as files for "Greensleeves" and the
"Dragnet" theme. You can create each of

	J1	SWITCHEE AL. '0'	; If yes, check which one. ; Is it a possible commend?
	JB	NEXT CAP	If no, get next byte.
	WOW	HEXT_CAP FARA_FLAG, 1	;Elce flog thet parameter exists.
	CHP	AL, 'e' NEXT_CAP	Ils it lover case?
	JB AND	NEXT_CAP	; If no, get nest byte.
	JMP	BYTE PTR [SI-1],5FR SHORT NEXT_CAP	;Is it a possible commend?; If no, get next byte.; Else fleg thet parameter exiets.; Is it lower case?; If no, get next byte.; Else, cepitelize.; West byte.
SWITCHES:	CNP	AL, "/"	:Is it switch character?
	JNE	GET_SWITCH	; If no, get next byte. ; Else creete ASCIII for DOS.
GET SWITCH:	LOOSE	SYTE PTR [SI-1],0	;Else creete ASCIII for DOS.
antica:	CHE	AL,13	;Get e byte. ;Is it carriege return? ;If yes, done here.
	JI	PARAMETERS	;If yes, done here.
	ANO	AL,5PH	Else, cepitelize.
	CMP	AL, 'E'	Else, cepitelize. Is it /X switch? If mo, check /F. Else, fleg es no keyboard poll. Is it /F?
	MOV		Else, fleg es no keyboard poll.
CK_FILE:	CHE	AL ' P"	ile it /F?
	JHS		; If no, get next byte.
	JHF	FILE_PLAG, 1 SHORT IN LTCHES	; If no, get next byte. ;Else, fleg es filespec. ;Get next byte.
Esit is her Before term	e so it insting,	cen be reached by se m reset clock to 18.2/m	any chort jumps es possible. ; ec end restore INT 6 vector. ;
EXIT:	CALL	SET_CLOCK	Divisor of 65536 or sero.
	MOA	DX, MORD PTR TIMER_TIC	Restore old vector
	HOV	AX, MORD PTR TIMER TIC	[2]
	MOA	OS, AX AX, 2500B	; of INT 8.
	INT	218	, 02 201 0.
	INT	2011	Terminete.
Check to se If yes, ree high bit, o cherecters	e if par d file i epiteliz	ameters esist and if y into buffer and process ring, stripping comment we. Finish by tecking	ee check if filespec. ; by stripping Wordster; s and stripping space ; on e carriege return.;
,		ameters esist and if y into buffer and process ring, stripping comment w. Finish by tecking	ee check if filespec.; by stripping Wordster; s and stripping space; on e carriage return;
Check to se ; If yes, ree ; high bit, c ; cherecters ;	СКР	ameters esist and if y into buffer and process ring, stripping comment w. Finish by tecking FARA_FLAG,1 FILE WARE	,
,	CKP JI MOV	ameters esist and if y into buffer and process ring, stripping comment w. Finish by tecking FARA_FLAG,1 FILE_MAME OX.OFFSET FILE	JAre there parameter? JIf yes, check if filespec. Else, point to MAY.OAT
,	СКР	ameters esist and if y into buffer and process ring, stripping comment w. Finish by tecking FARA_FLAG,1 FILE WARE	re check if filespec. ; by stripping Wordster ; s and stripping space ; on e carriege return. ; JACE there parameter; jif yes, obeck if filespec. jElms, point to PLAY.OAT; s and open file.
PARAMETERS:	CKP JE MOV JMP	emeters esist and if y into buffer and process ing, stripping comment w. Finish by tecking FARA_FLAG,1 FILE_MAME OX,OFFSET FILE SEORT OPEN_FILE	Are there parameter; iff yes, check if filespec. illae, point to PLAY.OAT; and open file.
,	CKP JE MOV JKP CKP	emeters esist and if y into buffer and process ing, stripping comment w. Finish by tecking FARA_FLAG,1 FILE_MAME OX,OFFSET FILE SEORT OPEN_FILE	Are there parameter; iff yes, check if filespec. illae, point to PLAY.OAT; and open file.
PARAMETERS:	CKP JE MOV JMP	emeters esist and if y into buffer and process ing, stripping comment w. Finish by tecking FARA_FLAG,1 FILE_MAME OX,OFFSET FILE SEORT OPEN_FILE	Are there parameter; iff yes, check if filespec. illae, point to PLAY.OAT; and open file.
PARAMETERS;	CHP JE MOV JHP CHP JNZ HOV	nameters esist and if y into buffer and process ing, stripping comment w. Finish by tecking PARA_FLAG,1 FILE_NAME OX.OFFSET FILE SECOTO OFFE, FILE FILE_FLAG,1 REAO_COMMAND DX,821	JATE there parameter? JIF yes, check if filespec. JIE yes, check if filespec. JIE is point to FLAY.OAT , and open file. JIE it e filespec? JIF no, reed the command line. JIEse, point to filespec.
PARAMETERS:	CKP JE MOV JMP CKP JNZ MOV	rameters esist and if y into buffer and process ing, stripping comment w. Finish by tecking FARA_FLAG_1 FILE_MAME OX, OFFSIT FILE SHORT OFER_FILE FILE_FLAG_1 READ_COMPAND DX, \$21	Are there parameter; iff yes, check if filespec. illae, point to PLAY.OAT; and open file.
PARAMETERS;	CHP JE MOV JHP CHP JNZ HOV	nameters esist and if y into buffer and process ing, stripping comment w. Finish by tecking PARA_FLAG,1 FILE_NAME OX.OFFSET FILE SECOTO OFFE, FILE FILE_FLAG,1 REAO_COMMAND DX,821	JATE there parameter? JIF yes, check if filespec. JIE yes, check if filespec. JIE is point to FLAY.OAT , and open file. JIE it e filespec? JIF no, reed the command line. JIEse, point to filespec.
PARAMETERS;	CKP JE NOV JKP CKP JNZ NOV INT JC	remeters esist and if y into buffer and process ing, stipping comment . Finish by tecking . Finish by tecking . FARA_TAG_1 . FILE_RAME CN_OPPSET_FILE . SHORT OFFE_FILE . FILE_FILE_1 . FILE_FILE_1 . FILE_FILE_1 . FILE_FILE_1 . FILE_FILE_1 . FILE_FILE_1 . FILE_1 . FILE_FILE_1 . FILE_	Ance there paramete? If yes, check if filespec. If yes, check if filespec. Is not open file. Is it e filespec? If no read the command line. Is me to filespec. Open file for reading. If not found, exit.
PARAMETERS;	CKP JE HOW JRP CKP JRZ HOW INT JC	TEMETERS ESIST AND ITY INTO DUITER AND PROCESS ING, SELIPPING COMMENT PARKLINGS PARKLI	Ance there paramete? If yes, check if filespec. If yes, check if filespec. Is not open file. Is it e filespec? If no read the command line. Is me to filespec. Open file for reading. If not found, exit.
PARAMETERS;	CKP JI MOV JMP CKP JNZ HOV HOV HOV HOV	TEMETERS ESIST AND ITY INTO DUITER AND PROCESS ING, SELIPPING COMMENT PARKLINGS PARKLI	JAce there parameter? Jif yes, check if filespec. Jims, point to PLAN.OAT j and open file. Jis it e filespec? Jif no, reed the command line. Jims, point to filespec. JOpen file for reeding.
PARAMETERS;	CKP JE HOV JRD CKP JRE HOV HOV HOV HOV HOV	rameters esist and if y into buffer and process ling, stripping comment of the stripping of t	Ance there paramete? If yes, check if filespec. If yes, check if filespec. Is not open file. Is it e filespec? If no read the command line. Is me to filespec. Open file for reading. If not found, exit.
PARAMETERS;	CKP JI MOV JMP CKP JNZ HOV HOV HOV HOV	TEMETERS ESIST AND ITY INTO DUITER AND PROCESS ING, SELIPPING COMMENT PARKLINGS PARKLI	Ance there paramete? If yes, check if filespec. If yes, check if filespec. Is not open file. Is it e filespec? If no read the command line. Is me to filespec. Open file for reading. If not found, exit.
PARAMETERS;	CRP JE HOV JMP CRP JEZ HOV HOV HOV HOV HOV HOV HOV INT	remeters esist and if y into buffer and process ling, stripping comment process proces	Pare there primeter: Pare the primeter primeter price price price to PAN ONE; Is it e filespec? If no, reed the command line. Is it e filespec? If no, reed the command line. Is it of command line. Is it of the price
PARAMETERS;	CKP JE MOV JKP CKP JKL MOV INT JC MOV HOV HOV INT HOV HOV HOV HOV HOV	remeters esist and if y into buffer and process ling, stripping comment process proces	Pare there primeter: Pare the primeter primeter price price price to PAN ONE; Is it e filespec? If no, reed the command line. Is it e filespec? If no, reed the command line. Is it of command line. Is it of the price
PARAMETERS;	CKP JE ROY JKP CKP JKE ROY	remeters eslat and if y into buffer and process ing, stripping comment or stripping FARA_TAG_1 THER_MAG_1 THER_MAG	the three primers; If yes, obesit filespec, If not found, eath, If yes, filespecifie in NY, If yes, filespecifie in NY, If yes, filespecifie in Deffer,
PARAMETERS;	CKP JE NOV JND CKP JNE NOV HOV HOV HOV HOV HOV HOV HOV HOV	commerce salet and if yet which buffer and process on the buffer and the buffe	Now there existence: if yee, Obec (f filespec, files, point to FAN.OAT files, point to FAN.OAT files, point to FAN.OAT files, point to filespec. files, point to filespec. ropen file for reeding, files, filespecial files, filespecial files, filespecial files, filespecial files, point to filespec. ropen file for reeding, filespecial filespeci
PARAMETERS; PILE_NAME: OPEN_FILE:	CKP JE HOV JND KOV HOV HOV HOV HOV HOV HOV HOV HOV HOV H	commerce salet and if yet which buffer and process on the buffer and the buffe	Now these primers; if yes, obset (filespec, files, point to FAN.OD; files, point to FAN.OD; files, point to FAN.OD; files, point to filespec, files, point to filespec, ropes file for reeding, files, filespec, filespec, suit. files, filespec, file
PARAMETERS; PILE_NAME: OPEN_FILE:	CKP JE JKP CKP JKE JKE HOV	memeter saint mod if y the buffer son pic w. finish by texting "PARLTAGA"	Now there existence: if yee, Obec (f filespec, files, point to FAN.OAT files, point to FAN.OAT files, point to FAN.OAT files, point to filespec. files, point to filespec. ropen file for reeding, files, filespecial files, filespecial files, filespecial files, filespecial files, point to filespec. ropen file for reeding, filespecial filespeci
PARAMETERS; PILE_NAME: OPEN_FILE:	CKP JE MOV SHP JE KOV INT JC MOV HOV HOV HOV HOV HOV HOV HOV HOV HOV H	memeter saint mod if y into biffer in of participation of the participat	Now these primers; if yes, obset (filespec, files, point to FAN.OD; files, point to FAN.OD; files, point to FAN.OD; files, point to filespec, files, point to filespec, ropes file for reeding, files, filespec, filespec, suit. files, filespec, file
PARAMETERS; PILE_NAME: OPEN_FILE:	CKP JT MOV MOV HOV HOV HOV HOV HOV HOV HOV HOV HOV H	converse saint mod if y models of the both of the saint o	Now these primers; if yes, obset (filespec, files, point to FAN.OD; files, point to FAN.OD; files, point to FAN.OD; files, point to filespec, files, point to filespec, ropes file for reeding, files, filespec, filespec, suit. files, filespec, file
PARAMETERS; PILE_NAME: OPEN_FILE:	CKP JT MOV SOV HOV HOV HOV HOV HOV HOV HOV HOV HOV H	converse saint mod if y models of the both of the saint o	Now these primers; if yes, obset (filespec, files, point to FAN.OD; files, point to FAN.OD; files, point to FAN.OD; files, point to filespec, files, point to filespec, ropes file for reeding, files, filespec, filespec, suit. files, filespec, file
PARAMETERS; PILE_NAME: OPEN_FILE:	CKP JI JKP CKP JKP CKP JKP CKP JKE JKP JKP JKE JKP	newest saids and if y the control of the control of the control w. Finish by techniq w. Finish by techniq FILE_MAN FILE	Now there existence: if yee, Obec (f filespec, files, point to FAN.OAT files, point to FAN.OAT files, point to FAN.OAT files, point to filespec. files, point to filespec. ropen file for reeding, files, filespecial files, filespecial files, filespecial files, filespecial files, point to filespec. ropen file for reeding, filespecial filespeci
PARAMETERS; PILE_NAME: OPEN_FILE:	CRP JI JRP CRP JRE	converse saint mod if y models of the both of the saint o	Now these primers; if yes, obset (filespec, files, point to FAN.OD; files, point to FAN.OD; files, point to FAN.OD; files, point to filespec, files, point to filespec, ropes file for reeding, files, filespec, filespec, suit. files, filespec, file
PARAMETERS; PILE_NAME; OPEN_FILE; PORMAT; CX_CONTROL;	CRP JIE MAY JRP CRP JIE JRC HOW	converge saiet and if y interpretation of the y interp	Name there periodically a service of the service of
PARAMETERS; PILE_NAME; OPEN_FILE; PORMAT; CX_CONTROL;	CRP JI MOV JNP CNP HOV	converge saiet and if y interpretation of the y interp	when there extended: If you, Once if filespec, if you check if filespec, if and open file, if one filespect and line, read of the continue, if one found, sait, files, filespect and in Ex- if you can be not the continue, if it is not buffer, if you are in the continue, if you are in the continue, if you, are in the continue, if you, are in the continue, if you, are in the continue, if you are in t
PARAMETERS; PILE_NAME: OPEN_FILE:	CRP JE MOV JHP CRP JEZ HOV HOV HOV HOV HOV HOV HOV HOV HOV HOV	converge saiet and if y interpretation of the y interp	Name there periodically a service of the service of
PARAMETERS; PILE_NAME: OPER_PILE; FORMAT; CX_CONTROL; REXT_FORMAT;	CRP JE MOV JHP CRP JEI	converse saict and if y income to saict and if y income to the saict sai	Note there extended to the control of the control o
PARAMETERS; PILE_NAME: OPER_PILE; FORMAT; CX_CONTROL; REXT_FORMAT;	CRP JI MOV JRP JRI MOV HOV HOV HOV HOV HOV HOV HOV HOV HOV H	converge saist and if you converge saist and if you can be a season of the saist and if you can be a saist and if you can	The three primers of the primers of
PARAMETERS; PILE_NAME; OPEN_FILE; PORMAT; CX_CONTROL;	CRP JE MOV JHP CRP JEI	converge saiet and if y interpretation of the y interp	Note there extended to the control of the control o



■ PROGRAMMING/UTILITIES

these as data files with your word processor, and then, for example, simply enter

PLAY STING.DAT/F

Or, by entering the data and naming the file PLAY.DAT, you could just enter PLAY with no arguments.

HOLIDAY FOR STRINGS The vertical but shown in the parameter syntax means you can give PLAY a string or filename, you can give PLAY a string or filename, but not both in one command. The 'K option will cause PLAY to ignore the keyboard. It can be included with either a string or, in the more practical case, with filenames. Use the 'K option if you don't want the user to interrupt the play, PLAY defaults to termination with any keystroke.

You can create data files with your word processor for the Scott Joplin rag "The Entertainer," as well as for "Greensleeves" and the "Dragnet" theme.

In the event that you use the PLAY.DAT option—that is, no parameters on the command line—and you wan PLAY to ignore user keystrokes, place a K at the beginning of the string in the file rather than on the command line.

PLAY works so nearly like BASIC's Play statement that it's easier to point out the differences than to list all the similarities. If you don't have a copy of the BA-SIC manual, you'll find the commands for PLAY.COM listed in the table "PLAY's Command Set "

PLAY does not recognize the < and > commands. These are reserved DOS characters, so I did not include them in PLAY's command set. Also, PLAY will not recognize the option of entering the length of the note after the note. In other words, use LIOA in place of A16.

STR1P:	JI LOOP JMP	MEXT_FORWAT MEXT_STRIP SBORT_END_FORWAT	; If yes get nest commend. ;Else, skip end get nest byte.
This is the	command	proceeeor. ;	
READ_COMMAND:	NOV	81,822	; Initialiss pointer to commands.
HEXT_COMMAND:	CMP JI MOV INT JNI LODGE	POLL_REY,1 GET_COMMAND AR,1 168 EXIT	;Should we poll keyboard? ;If no, ekip. ;Else, check for keystroks ; vis EloS. ;If keystroke, ssit.
del_common	CRP JA JRP	AL,13 CONTINUE EXIT	;Elss, gst e byts. ;Is it carriegs return? ;If no, continus. ;Else, we srs done. ;Is it mpscs, comma or semicolon?
CONTINUE:	OND DI OND DI OND	AL,32 NEXT_COMMAND AL,',' NEXT_COMMAND AL,',' NEXT_COMMAND	; If yee, ekip.
	CMP JSS CALL CMP JA MOV JRP	AL,'O' CE_L CE_MUMBER AL,7 MEXT_COMMAND OCTAVE,AL SHORT NEXT_COMMAND	pls it "O"; Octawa? plf no, check "L". plass, get number. pls it in range? plf no, kip. plies etors.
OLL:	CMP JA CMP JA JA JA JA	AL, 'L' CK, TEMPO CK, MUMBER AL, B MENT_COMMAND AL, 64 MENT_COMMAND DK, DK	pls it "L" : Length? plf no, check tempo. plf no, check tempo. plf no, check tempo. plf no, skip. pliee, zero in high balf.
	NOV NOV JRP	AX,256 BX LEN,AX SHORT NEXT_COMMAND	Dividend of 256. Divide by length and stors.
CK_TEMPO:	CMP JNI CALL CMP JB HOV SUE INC	AL, "T" CK_R CK_NUMBER AL, 32 MENT_COMMAND AX, 255 AL, BL AX	pls it "Y" ; tempo? plf no, check number. ple it between 32 end 255? plf no, skip. plee, complement. Haks no zero
	HOV JMP	SHORT MEXT_COMMAND	; and stors.
CK_N:	ONP ONP ONP ONP ONP	AL, 'N' CK_NOTE CK_NOMER AL, 84 NEXT_COMMAND AL, 8	yls it "R" ; number? ylf no, check note. ;Else, get number. yls it between 8 and 84? ylf no, ekip.
G07_N:	DEC XOR DEC DEC	GOT_H ALL, AM CL, 12 CL	padjust number. plero in high helf. phivids by 12.
	SUB HOV	CI,8 CL,AL EL.AR	;Get octeve. ;Remainder in BX pointer.
	XOR SEL HOV	BH,EE EX,1 BX,[OFFSET NOTE+BX]	;Adjuete ee word pointer. ;Ratriava nota.
	CALL	PLAY_MUMBER MEXT_COMMAND	Plsy the note.
CK_NOTE:	CKP JE CKP	AL, 'A' COMMAND_END AL, 'G'	; Ie it letter note ; A-G?
	JA CMP JB SUB	AL, 'G' CK_P AL, 'C' ABOVE_C	plf no, check pause. prirst subtract 7 for C and above
ABOVE_C:	SUB SUB XOR	AL, 68 AR, AR	First subtract 7 for C and above Finish points; adjustment. Staro in high half.

(Figure 1 conti-

	WOV	DI,AX	:Nove into pointer.
	MOV	CL,2	Convert to word pointer
	SHL	DI,CL	, by multiplying by 2.
	CMP	DI,8	Adjust if necessary.
	JBE	GOT_NOTE	
	BUB	D1,2	
GOT_NOTE:	CALL	BLACK_KEY PLAY	Check for charps or flate.
	JEP	MEXT_COMMAND	Pley the note.
CK_P:	CNP	AL,'P'	;Ie it "P" ; pauce?
	JRE CALL	CK_E	; If no, check key poll.
	CNP	CK_NUPB ER	Files, get number. File it between 1 and 647
	JE	AL, S COMMAND_END	
	CMP	AL,64	; If no, ekip.
	JA	COMMAND END	
	XOR	DX - DX	Elee, zero in high belf.
	MOV	AX, 256	Dividend of 256.
	DIV	RX	Divide by length
	MOV	BP. AX	(Fenze in BP.
	CALL	PAUSE DELAY	71
	JMP	NEXT_COMMAND	
CK. S:	CKP	AL. '3'	; Ie it "E" ; non keyboard poll;
	JNE	CK K	ilf no. check music.
	MOV	POLL REY. 1	iblee, flag se no poll.
	JRP	MEXT_COMMAND	
CK_KI	CMP	AL. 'H'	; Ie it "H" ; mueic?
	JNE	CORRAND END	ilf no. neet commend.
	LODES		Else, get neet byte.
	CMP	AL, 13	
	JKS	CK_M2	
	JMP	EXIT	
CK_N2:	CMP	AL, 'H'	;le it "N" ; normal?
	JKI	CK_L2	IIf no, check L.
	YOU	MUSIC,1	;Elee, fleg ee mueic one.
CK_L2:	CHP	AL, 'L'	; Ie it "L" ; legeto?
	JHI	CK_B2	; If no, check S.
	MOV	MUSIC, 2	'Else, flag as music two.
CK_B2 i	CHP	AL, 'B'	lie if .P. scaccato.
	JNE	COMMAND_END	; If no, ekip. ;Blee, fleq os nueic three.
COMMAND_END:	JRP	MUSIC, 3 NEXT_COMMAND	intee, ried se music three.
		routinee :	

,			
This subrou	tine co	everte decimel comm	and number to hee. ;
,			•
CK NUMBER:	XOR	mx. mx	Initialise to sero.

CK_NUMBER:	XOR	BX, BX	Initialies to sero.
REXT NUMBER:	CHP	BYTE PTR [SI], 'S'	:le it e number?
	38	END NUMBER	ilf no, we're done.
	CMP	BYTE PTR [BI] . '9'	
	JA	END_NUMBER	
	LODES		(Get number.
	SUB	AL.358	(Convert to bex.
	MOV	DL.AL	
	YON	AX.18	shift decimal by ten
	MUL	RL	
	YON	BL, AL	Result in BL.
	ADD	BL.DL	Add new number.
	JEP	SHORT NEXT NUMBER	Get neet number.

. This subrouting checks for sharps or flats.

END_NUMBER:

BLACK_EBY:	CKP	BYTE PTR [BI], '+'	; Ie it sherp?
	JNE	CK_SHARP	; If no, check 0.
	ADD	D1.2	Blee, point to neet note.
	INC	BI	Addust commend pointer.
CK_SHARP!	CHP	BYTS PTR [BI] .'4'	Do same for 4.
-	JKS	CK FLAT	
	ADD	D1.2 .	
	INC	SI	
CK_FLAY:	CMP	BYTE PTR (SI),'-'	;Do same for flet escept
	JNE	END BLACK	; decrement note pointer.
	SUB	DI,2	,
	INC	BI	
END BLACK:	RET		
			(Figure 1 continue:



Here are the commands to which PLAY.COM responds.

- K Keyboard. K will cause PLAY not to poll the keyboard during play. If K is not found, any keystroke will
 - On Octave. n is a decimal number between 0 and 6. Middle C starts 03. The default is 04.
 - Ln Length of time the notes will be played until the next L command is encountered. n is a decimal number between 1 and 64. For example, L4 = quarter note (1/4)
 - and L8 = eighth note (½).

 To Tempo is the pace at which the music is played. n is a decimal number between 32 and 255. The larger the number, the faster the pace. The default is T120.
 - pace. The default is T120.

 Letter names corresponding to the notes of the scale. The letter name may be followed by either "#" or "+" for a sharp, or "-" for a flat. 03C = middle C.
- No Note to be played, n is a decimal number between 1 and 84. Each increment is 1½ of an octave. N can be used as an alternative to defining a note by a letter and an octave. For example, N37 = middle C.
 - Pn Pause, or rest, for a length defined by n. P works in the same way as the L command above. For example, P2 = a half rest.
 - MN Music Normal. The note is played 1/6 of its specified time, and 1/8 is a rest between notes. This is the default.
- ML Music Legato. The note is played the full length of the time specified.

 MS Music Staccato. The note is
- MS Music Staccato. The note is played 34 of the time specified, and 14 is a rest between notes.

 Dot. A dot can follow a letter note
 - Dot. A dot can follow a letter note or a pause. A dotted note increases play time by half the duration of the note or pause. More than one dot may be used.

Return with number in AL.

PROGRAMMING/UTILITIES

BASIC's MF and MB commands make no sense to PLAY.COM, and the X variable is also ignored. If any of the above commands appear in BASIC strings you have already constructed, you'll want to edit them out. Otherwise, PLAY.COM's command set is the same

If you've already "scored" a certain number of strings for use in BASIC, you can save the time of retyping them by loading the BASIC program that contains the play strings and then saving it with the AS-CII option. That is

SAVE filespec.A

Next, exit BASIC to DOS and load your word processor with the BASIC listing. then edit out all but the PLAY command strings. Unlike BASIC, PLAY's file

strings can be longer than 256 bytes. Comments can be added by prefacing them with a colon. Anything after the colon on the same line will be ignored by PLAY. The colon works the same way

LAYı	HOV	BX, [OFFSHT NOTE+DI]	;Retrieve the note.
	MOA	CX,B	Complement the octave.
	SUB	CL, OCTAVX	
LAY_NUMBER:	SRR	BX, CL	Divide by octave base two.
	NOA	DX,128	120000h dividend constent.
	XOR	AX, AX	
	DIV	BX	Divide by frequency.
	NOV	BX.AX	store in BX.
	MOV	AL, ODEH	;Latch to Channel 2.
	OUT	43 B, AL	
	MOV	AX, BX	Bend LSB then MSB to #253.
	OUT	428, AL	
	NOV	AL, AH	
	OUT	42B.AL	
	IN	AL, 61B	
	OR	AL.3	Turn bite # and 1 on \$255 chip
	COLL	618,AL	; to turn speeker on.
	CALL	DELAY	Deley.
DPF 1	IN	AL,618	Turn bite # and 1 back off.

Thie subroutine calculates the length of play.

AL,1111111008

(Figure 1 continue

DOWNLOADING PLAY

The programs that appear in our Pro-gramming/Utilities column (as well as other programs we publish) can be downloaded by modem from the PC Magazine Interactive Reader Service. There is no charge for this service, but users are cautioned that these programs are copyright material and are made available only for individual, noncommercial use. You may make copies for others (including placement on noncommercial electronic bulletin boards), as long as no charge is involved. However, making copies for any commercial purpose is strictly prohibited.

The modern number for PC-IRS is (212) 696-0360. Set your modern and communications software to use 1,200 (or 300) bos, 8 data bits, 1 stop bit, no parity. PC-IRS files with a .COM. .EXE. or .ARC extension require that you also use the Xmodem error-checking protocol; our other files (e.g., with extensions of .ASM or .BAS) can be downloaded using either regular ASCII or Xmodem transmission. PC-IRS has 18 lines and is open 24 hours a day. PLAY.BAS, whether typed in from the magazine at your keyboard or downloaded from PC-IRS, will automatically create PLAY.COM when run once in BASIC. PLAY.ASM, also listed both here and on PC-IRS, allows you to modi-

fy the program but requires you to use a macro assembler (IBM or Microsoft) and the following commands:

MASM PLAY: LINK PLAY:

EXE2BIN PLAY PLAY, COM

Delay for pause batween notes

PLAY AT A GLANCE

The syntax for PLAY.COM is

PLAY [etring[/E] | fileepec/F[/E]]

Operation: PLAY.COM is intended to provide many of the music-producing functions of the BASIC PLAY statement without the need to work in BA-SIC. If entered with no arguments on the command line, PLAY looks in the current directory for a file named PLAY DAT and executes the commands in that file.

Alternatively, PLAY can use either | Command Set."

a command-line string or any legal DOS filename to supply the music command arguments. When the musical "score" is in a file, a /F must be appended to the filename. Filespecs may include a path designation. With either

a directly entered string or a filename. an optional /K switch may be added to prevent a keystroke from halting execution The music-generating commands to

which PLAY.COM responds are listed in the accompanying table "PLAY's

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■ PROGRAMMING/UTILITIES

that the apostrophe does in BASIC and the semicolon does in assembly.

INSIDE THE CODE. This is how PLAY works. The parsing of the command line is straightforward; you've seen it a dozen times in other assembly language programs. All commands, whether they come from the command line or from a file, are capitalized by ANDing with Fish, and file strings are also ANDed with The to strip the WordStar high bit. If you let I have the property of the prope

Before executing the commands, PLAY strips any comments and any characters equal to space or below. This is done by initializing the source (SI) and destination (DI) registers to point to the beginning of the buffer. Each byte is then loaded with LODSB. If the character is found to be above space, it is stored with STOSB. If the character will be stored until PLAY sees a linefeed (OAh).

When the end of the buffer is reached, PLAY tacks on a carriage return. PLAY's cut to terminate and return to DOS is the carriage return at the end of the command line or at the end of file data.

A long loop is used to examine each character to see whether it is a command. At the beginning of each loop, if PLAY does not find a K in the string or K on the command line, an INT 16h is issued with AH = 1. This BIOS routine will return with the zero flag cleared (not zero) if a keystroke is available, and the entry remains in the keyboard buffer. If a key has been struck, PLAY exits.

To interpret a command, PLAY examines each character in the string for supercommand letter. If, for example, L is found, the number characters that follow it are converted from destinal to bet and stored in a variable called LED. When the letter to a pointer by subtracting 41h. And the subtress mail correction is then made to place the A and B at the end to reflect the other of the scale, namely CDEFGAB. The pointer is then used to retrieve the appearance of the control of the cont

DELAY:	MOV	BP, LEN	;Retrieve length.
PAUSE_DELAY: NEXT_DOT:	HOV CKP	CX, SP SITE PTR [SI], '.'	Store in CK.
MAI_MI	JRI		; If no, got length.
	INC	SI CX,1	plice, edjust commend pointer. plivide length by two end.
	ADD	BP,CX SHORT NEXT_DOT	; If no, got length, ;Elee, edjust commend pointer. ;Divide length by two end. ; edd to totel length. ; Check for another dot.
GOT_DELAY:	NOV	CX,87	rienath in CX.
	PUSS	CX MUSIC,2	Seve. Te it mueic legeto?
	JI	MAIT	if yee, pley full length.
	HOV XOR	AX,CX DX,DX	gElee, length in AX.
	CMP	MUSIC,1	;Ie it mueic normel?
	HOL	CX.7	;Ie it music normel? ;If no, must be music stacetto. ;Multiply by 7/8.
	HCW	G.,1	
	SHR	CY.AY	
	JXP	SHORT WAIT	
MUSTC_3:	HUL	a.,3	#Multiply by 3/4.
	SHR	CL, 2 AX, CL	
	HOV	CX,AX	
WAIT	POP 908	BX,CX	;Subtrect pause time.
STACCATO:	HOV HUL	AX,TEMPO CL	;Retrieve tempo. ;Multiply by length of mote.
	XOR HOV	CL DX,DX CX,280	:Adjust by looping constent.
	DIV	CI AX	Prevent eero loop,
	HOV		
	ADD	CX, COUNT CX, AX	;Get present counter. ;Add length of note.
NEXT_DELAY:	JB HOV	END_DELAY AX,COUNT	:Skip if count wrepped.
MOAI_MOUNT!	CNP	AX.CX	;Bee deley expired?
END_DELAY:	CRP JB RET	AX, CX NEXT_DELAY	:Skip if count wrepped. :Get counter egain. :Bee deley expired? :If no, get counter until it does
END_DELAY:	CMP JB RET	AX, CX NEXT_DELAY	,
END_DELAY:	JB JB MET	AX,CX NEXT_DELAY	te 8253 chip. ;
END_DELAY:	DEP JB RET time pr	AX,CX NEXT_DELAY ograme Channel # of th	te 8253 chip. ;
END_DELAY:	CMP JB HZT time pr MOV COT HOV	AX,CX NEXT_DELAY ograme Channel 8 of th AL,801101105 418,AL	,
END_DELAY:	CMP JB RET time po	AX,CX NEXT_DELAY ograme Channel 8 of th AL,60118118B 438,AL AL,68	te 8253 chip. ;
END_DELAY:	CMP JB RET time po HOV OUT HOV OUT	AX,CX NEXT_DELAY ograme Channel 8 of th AL,801101105 418,AL	te 8253 chip. :
END_DELAY: 1 This subroc SET_CLOCK:	CMP JB JET ZET Line pt GUT HOV GUT HOV GUT HOV GUT HOV GUT HOV GUT HOV	AX, COURT NEXT DOLLAY OGRAMS CHANNEL 8 of th AL, 801181189 438, AL AL, 82 485, AL AL, 82	te 8253 chip. :
END_DELAY: 1 This subroc SET_CLOCK:	CMP JB JET ZET Line pt GUT HOV GUT HOV GUT HOV GUT HOV GUT HOV GUT HOV	AX,CX NEXT_DELAY ograme Channel 8 of th AL,60118118B 438,AL AL,68	te 8253 chip. :
END_DELAY: 1 This subroc SET_CLOCK:	CMP JB RET HIND PE HOV GOT HOV HOV HOV HOV HOV HOV HOV HOV HOV HOV	AX, COURT NEXT DOLLAY OGRAMS CHANNEL 8 of th AL, 801181189 438, AL AL, 82 485, AL AL, 82	te 8253 chip. ;
END_DELAY; ; ; This subrow; SET_CLOCK; ; This is the	CMP JB JB JB JB JB JB JB JB JB JB JB JB JB	AL. CE SITT DELAY AL. SELISIES AL. SELISIES AL. SELISIES AL. SL 489, AL 489, AL 7 S Interceptor.;	y 223 chip, ; jatch to Channel #. jeend LEB then REB.
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB	NLC TO STATE OF THE STATE OF TH	w 2230 chip, ; jeatch to Chennel 8, jeend LEB then KEB.
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB BZT ALIDS PO COT MOV MOV MOV MOV MOV MOV MOV MOV MOV MOV	AX. CT	y 223 chip, ; jatch to Channel #. jeend LEB then REB.
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB RET MOV COT MOV COT MOV COT RET STING STI POSS FOSS FOSS FOSS FOSS FOSS FOSS	ALC T ALC STILLIAN ALC STILL	n 1232 chip, slatch to Chemmal F, slatch to Chemmal F, slatch to Chemmal F, slatch then MMB. State State
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB	M. CC. Michael Pot th M. Miller Room Pot th	y 223 chdp., jatch to Channel 8., jeed LEB then MEB.
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB JB JB JB JB JB JB JB JB ACT KING DOT ROV OUT RET OUT RET FORE FORE FORE FORE FORE FORE FORE FORE	M.CC SITE PELAY POPULAR AL, 801181189 AL, 801181189 AL, 801181189 AL, 801181189 T S interceptor. ; T C CC CCC CCC CCCC CCCC CCCC CCCC C	n 1232 chip, slatch to Chemmal F, slatch to Chemmal F, slatch to Chemmal F, slatch then MMB. State State
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB	ALCO	is 6232 cktp. ; joint 10 Chemen F. joint Lim then the , joint Lim then the , joint register. jhorement our counter. jOint If divisible by 4.
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB JB JB JB JB JB JB JB JB A A A A A A	ALCOMENTATIONS OF THE PROPERTY	n 1232 chip, slatch to Chemmal F, slatch to Chemmal F, slatch to Chemmal F, slatch then MMB. State State
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB A A A A A	M. CC STEELERS SOURCE AND STEELERS AL SELECTION AL SELECT	is 6232 cktp. ; joint 10 Chemen F. joint Lim then the , joint Lim then the , joint register. jhorement our counter. jOint If divisible by 4.
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB JB JB RET MOV GOT MOV MOV MOV MOV MOV MOV MOV MOV	ALCOMENTATIONS OF STREET STREE	is 6232 cktp. ; joint 10 Chemen F. joint Lim then the , joint Lim then the , joint register. jhorement our counter. jOint If divisible by 4.
END_DELAY; ; ; This subrow; SET_CLOCK; ; ; This is the	CMP JB RET ACV COTT MOV COTT MOV COTT MOT MOT MOT MOT MOT MOT MOT MOT MOT	ALCO AND	is 223 cktp. sleech to Chemon 6, sleech to Counter, sleech to Girialise by 4, sleech to Chemon 6, sleech to

AL,28H 28H,AL

|Send 8259 command port EOI end-of-interrupt Reetors other registers :Interrupt return.

768 798 688 818 182, 68,

838 848 DATA

DATA DATA DATA DATA DATA DATA DATA

DATA DATA DATA DATA DATA DATA DATA 117, 116, 117, 212, 117, 117, 255, 227, 12, 162, 23, 68,

73, 1, 285, 5, 188, 184, 216, 63, 191, 116,

117,

REM -- BASIC PR

PIELD 41,1 AS AS CHECKSUR - 8

(Figure I ends

156 166 176 LINESDM = 8 POR J = 1 TO 8 READ BYTE 198 READ BYTE CHECKSUM - CHECKSUM + BYTE LINESUM - LINESUM + BYTE 10 (BYTE < 256) THEN LIST IF FUT LEET AS - CHRS(BYTE) 218 228 238 248 HECK CX C LINEADS THEN PRINT "Error in Line"; 288 + 18 * 1 NEXT 1 CLOSE 1F CHECKSUM PRINT "COM 1 258 268 278 278 288 298 398 316 328 338 346 356 376 386 396 486 416 DATA DATA DATA DATA DATA DATA DATA 46, 188, 136, 69, 74, 114, 72, 88, 65, 77 1 73 92 116 64. 65, 82, DATA DATA DATA DATA DATA 200 77 184, 184, 286, 184, 128, 16, 46, 128 65 64 33 1 37 123 183, 76, 8, 2, 62, 186, 128, 129, 47, 6, 128, 117, 118, DATA DATA DATA DATA DATA DATA DATA 428 438 448 184, 8; 175, 38, 7, 33, 198, 68, 198, 234, 47, 68, 117, 78, 235, 45 I 46 I 47 I 494 588 514 528 538 548 558 DATA 48, 546 738 DATA DATA DATA DATA DATA DATA 255, 198, 44, 6, 198, 8, 1, 37, 95, 68, 36, 189, 235, 255, 95, 116, 198, 228, 187, 571 788 877 Ť.

OGRAM TO CREATS PLAY.COM AS 41 LEN = 1

THE SOUND OF MUSIC The chromatic scale is based on precise mathematical formulas, making it easily adaptable to the computer. Counting the black keys, the piano produces 12 tones in each octave, and each octave is a multiple of 2 of the previous octave.

Each note in the scale is a function of the power of 2 to the 1/12 power. The formula to arrive at the constant ratio between notes follows:

freq2 = freq1 * 21/12 = 1.859463

PLAY avoids the floating-point multiplication needed to calculate the frequencies by creating a table of the 12 notes of the highest octave (octave 6). These frequencies can be found in the data section of the assembly listing. Since each octave is a multiple of 2, calculating a note of a lower frequency is a breeze with the SHR instruction. Each shift to the right will divide by 2.

Once the frequency is found, it has to be converted to a divisor for the 8253 chip. The divisor is inversely proportional to the frequency. The appropriate dividend constant for the 8253 is 120000h. This is divided by the frequency and fed to the 8253 chin. More on that in a moment. The length of time the note is to be

played is retrieved from the variable LEN. LEN is partitioned into play time and pause time. MN, the default, plays the note 3/4 of the total length specified and pauses 1/4 of the time before proceeding to play the next note. Once the 8253 chip is set up, the speaker is turned on for the duration of a delay loop, after which the speaker is turned off.

PLAY programs two chips on the system board to control the frequency of the note and the length of play time. A third chip responsible for end-of-interrupt is also programmed in the process.

It's in the programming of the 8253 interval timer and the 8255 peripheral interface (see Figure 4) that PLAY becomes interesting. There are two ways to control the speaker. One is to pulse the speaker by directly programming the 8255 by sending a zero to bit 0 and a one to bit 1 very rapidly. The rate of pulsing controls the frequency of pitch.

The second method-the one used by

139, 216, 128, 98, 1, 61, 93, 33,

68

118, 198, 68, 198, 116, 172, 68, 68, 93 18 138 6 68 32 59 178, 4, 116, 188, 13, 116, 116, 235, 8, 192,

232

64 247

23 2, 64, 33, 116, 62, 139, 188,

58

95, 196, 172, 247, 189, 22, 233,

233, 79, 119, 76, 116, 184, 928 948 774

1841 726

773 898 1147

161, 285, 524

285, 248, 93, 68,

36, 5 46

236, 14, 226, 62, 285, 3,

184. 235

158

68, 254, 185,

18, 186, 114, 8, 198, 127, 235, 69, 33,

27, 226, 235, 239, 128, 1,

287, 68, 51, 67, 232, 218, 1819 759 1876

2, 241

185, 288, 36, 114,

163

162 116 246

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(Figure 2 ends)

PLAY—is to first program the 8253 with a divisor for channel 2 and then let it drive the speaker by sending the 8255 chip a one to bit 0 and a one to bit 1. The 8253 chip then sends the speaker pulses at a frequency dependent on the divisor.

The 823 has three timers on different channels, two of which interest PLAY. Port 43h is in charge of determining which channels is to be landed on the hist Noporgram the frequency, we want to talk to channel 2 of the 8233. Port 43h landed on the to channel 2 by tunning bit 7 on and bit 6, of 17. Turning on hits 5 and 4 of the same port tells the chip we will be sending a word a byte at a time. (To avoid unnecessary confusion, I'll skip the explanation of the other hits.)

Next, the divisor can be sent to the 8253 via port 42h. Like all the other examples of backward storing in the PC, the least significant byte (LSB) is transmitted before the most significant byte (MSB).

speaker.

Once the 8253 is programmed, the speaker is turned on by turning on bits 0 and 1 of the 8255. Communications to the 8255 arcs served through port 61h. Thanks to the 8253. PLAY can then go about its business of calculating the length of play without continually having to oulse the

AS TIME GOES BY You have grobully some depty loops exceeded by looping, some depty loops exceeded by looping, some depty loops exceeded by looping, some depty loops exceeded by looping the state of the different loops exceeded by looping the state of the different loops exceeded by looping the state of the different loops as the loop of the loop that the loop is looping to loop the loop that the loop is looping to loop the loop that loop t

lay loop accordingly. But with all the accelerator boards and all the clones on the market now, this, too, would give inconsistent results.

The only reliable method for executing delay loops is to monitor the system clock. The minute-second-millisecond word of the clock is found in low RAM at 40xCh. This clock is normally updated by the BIOS 18.2 times a second. Channel 0 of the 8233 is responsible for sending the interrupt (IRQ 0) that updates this word. The reason 1 say "normally" is because 18.2 times per second is not a fine enough resolution to time trills in PLAY.

oThe Enterteiner by Scott Joplin

O4MLL6#C#HNL16DECO3L#AL16BHBL#G MLL64C#HNL16DECO3L#AL16BL#MSGRM O2MLL64C#HNL16DECO3L#AL16BL#MSGRM MSL#GRMP4O3L#GCO2L16HLDMND#

:Prelude

```
MLD2L16EMSL803CML02L16E03MSL8C
        DILLEGISTANCE LICENTE CONTROL CONTR
     LOZL16EMSL803CHL02L16E03MSL8C
 PANO 4CLBEL16DCO3A
O4LBD, O1L16MLDMND
 MLG2L16EMSL8G3CMLG2L16EG3MSL8C
MNG2L16EG3L4C.L16G4CDD8
ECDL8EL16G3EG4MSL8D
 MNCL1603HLBGO4MSL8CHNL16CD
ECDL8EL16CDC
 ECDL#EL1603BO4L#HSDMH
L5MLC.MNL16D3EPF4
O3 LBHDGHKL16ALBGL16EFF#
 MSL8GMNL16ALFGL16MSECO2G
MLL16ABO3CDEDCD
RLLIGABOJ CDEDCD

RROJGHKJOS PEDAGENNF
LBRIGGHKLIGALBGLIGEFFB
LBRIGGHKLIGALBGLIGGAB
BLFBLIGAFBD
LSRUG, RKLIGEFFB
RELBGRNLIGALBGLIGEFFB
LBRIGGHKLIGALBGLIGEFFB
LBRIGGHKLIGALBGLIGEFFB
LBRIGGHKLIGALBGLIGEFFB
Lémagneliéaléaliéale.2003/MPS
MLABAG COEDCD
MSLÉMICLIÉEANDS-CO4/MPSP4G
MSOSIECAMBELIÉADS-CO4/
GOS CELBGLIÉEAD4G
MSLÉMADS-COMLIÉEAD9
LéC., LiéG4EFF9
MSLÉMADS-COMLIÉEAD9
MSLÉMADS-COMLIÉEAD9
MSLÉMADS-COMLIÉEAD9
 RSLEGHNL16ALEGL16EFF
LEGL16ALEGL16HSECO3G
 G1G04EFGAGEP
MSLEGMKL16AL#GL16EFF#
 LEGLI SALEGLI SGANS
 BT SBBLL 6A PSD
 HLL4 4GAGAGAGAGAGAGAGA
LB MSGL1 6ALBGL1 6BPPB
                                          GAGAGAGL16 MNEFF 6
 LEGILIEALEGILIEMSECO3G
MNABO4CDEDCD
 MSARO &CDEULU
MSLBCL1 & MLEGOS MNCO PGP PG
05 MSLB CO 4 MNC1 6 AMLOS LB CL1 6 O PAOS
CDP AGOS CELBGL1 & ECO PG
 LB MSAOS CHNL1 6ELBDL1 6NLC
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Figure 3: Three sample music selections for use

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: Greensleevee
```

OSA O4L2CL4D E.LEFL4E L2OL4OSB G.LBAL4B O4L2COSL4A OSA OLICCAO E.IBTLEE LOCACIS G.IBALES ORIZCOSLAR A.ISCHAR INSERTED G.IBALES ORIZCOSLAR INSERTED G.IZA. LZA. ORIZC. LOCACISTICA ELDOSLAS G.IBALES LZO4COSLAR A.IBGELAR LZBLEES LZE. ORIZC. LOCALISTICA ELZOSLAS G.IBALES LZO4COSLAR ORIZC. LOCALISTICAS LZOSLAS G.IBALES O4L4C.O3L8BL4A G#.L8F#L4G# L2A. A.

To produce the "Dregnet" theme, enter PLAY T98 02 LSE, L1699 LSG E F2 LSE, L1699 LSG E

Then try entering PLAY, followed by e single space end the following, continuous etring on the command line:

T19002L4EL8EL4NLG. NNL4G.EL8GL4AL8AL4NLG.NNL2G.L4EL SEL4NLG.NNL4G.EL8GL4AL8AL4NLG.NNL2G.T98L8E.L16F4L8 GEP2L8E.L16F4L8GEL3B-

(Figure 3 ends)

8259 chip 28h Port eddress Send 28h to this port to indicate end-of-interrupt.

8253 chip

48h Port eddreee Channel 8 Bend e divisor of zero for normal 18.2/sec clock ticke. A divisor of 16.384 generates 72.8/sec clock ticke.

42h Port eddrese Chennel 2

Send e divisor to change the frequency of the apeaker. 43h Port eddrese Hode control letch

88 = channel 8 81 = channel 1 18 = channel 2

hite 5-4 ## = letch precent counter velue #1 = reed/write LSB 18 = reed/write MSS 11 = reed/write LSB, then MSB

8255 chip

61h Port eddres

Turn bite 8 and 1 on to drive speeker vie Chennel 2. Turn hite 8-and 1 off to turn speeker off.

hit 1 l = epeeker enehle 8 = epeeker disable

1 = epeeker control vie 8253 channel 2 8 = direct epeeker control vie hit 1

Figure 4: The port addresses used in programming PLAY.COM.

If PLAY reads the system clock, turns on the speaker, and then sits in a loop reading the clock until it is incremented by one, the finest resolution can be only one-eighteenth of a second. Sound fast enough? Not if you want to produce chirping

To increase the resolution, then, PLAY programs channel 0 of the 8253 to generate an interrupt four times as often. Normally the divisor for channel 0 is 65,536 or zero.

By changing it to 16,384, the interrupts will occur 72.8 times a second. Now we're ticking.

Programming channel 0 is similar to programming channel 2. First it must be

latched-this time by turning both bits 7 and 6 of port 43h off. Then the divisor can

he sent a byte at a time to port 40h This faster clock speed creates a small problem, however. With the timer tick intem clock will run four times as fast as well. I'm talking about the clock you see when you enter TIME at the DOS prompt. With short command line entries, this speedup of the clock would not be noticeable, and even with longer file entries, the clock would gain a minute or two at the most. But we might as well get things right.

The solution is to take the timer tick (INT 8). Then on each tick of the system clock, PLAY gets serviced first and passes on the interrupt to the BIOS at every fourth interrupt. An IRET is issued on the other three interrupts, so the system clock is not updated. It's a simple feat to take over an interrupt. You've seen it before in resident programs, so I won't go into the details

■ The last thing PLAY does before exiting is set the system clock back to its normal 18.2

ticks per second.

here. There is, however, one thing that should be mentioned that must be done before an IRET. The 8259 command port, 20h, must receive a 20h to signal end-ofinterrupt so that other interrupts can occur. (I didn't stutter on that 20h. It just so happens that the port address and the bit settings are both 20h.) The assembly instruc-

MOV AL. 20H OUT 20H, AL

tions are

Finally, the last thing PLAY does before exiting (INT 20h) is restore the INT 8 vector to the way it was originally, thereby setting the system clock back to its normal 18.2 ticks per second.

Now go have some fun playing with PLAY. Why fix the roof or manage files on such a sunny day?

Michael J. Mefford is a microcomputer consultant who works out of his home in Gleneden Beach, Oregon.

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SPREADSHEET CLINIC



Adding accents in 1-2-3, simplifying text centering, running copy-protected software from a RAMdisk, and an easy approach to data security.

THE INTERNATIONAL TOUCH

Release 2 of I-2-3 lets you put international characters in your text, but only by means of a clumsy "compose" sequence. For example, to compose an uppercase with an umlaut (Â), you have to hit Alt-Fl, Shift-A, Shift-" just to get one character, If you use a lot of such characters, his routine can really slow you down. Thave written several macros, shown in

Figure 1, that make it easier to go intemational. Obviously, the simplest solution would be to write a separate macro for each letter, so you would hit Alt-A for Å, Alt-O for Ø, etc. But what about lowercase letters with umlauts? If you use up one macro per character, you'd have to use something besides Alt-A for a

My macros let you choose between upper- and lowercase within the same macro. When you run the first macro, \A, you get a lowercase A with an umlaut provided you type something within I second. Whatever you type will immediately follow the a normally. If you wait more than 1 second after running the macro, the å will automatically change to an A. after which you can again continue typing. I have made the lowercase letter appear first because most letters with an umlaut are lowercase. A delay of one second works best for me, but you can adjust it by changing the contents of the @ time function. The next two macros, \O and \U, work the same way for the letters O and U.

All three macros use the LOOK keyword to see whether you have typed a character while the macro is running. By

lay, you cause the execution of one branch. By waiting for I second, you

cause execution of the other branch.

The last macro, VE, has an additional line that lets you choose one of three kinds of accents for an E. If you want an acute

LOOPA

accent, just keep typing. For a circumflex, bit the Spacebar. If you want a grave accent, wait I second.

If you set up these macros, be sure to give the range names in the left-hand column to the cells to their right. This in-

ALET START, @now}
{LOOK IN_CHAR}
{IF IN CHAR}
{IF IN CHAR*"}
{quit}
{IF #ROW-START+@tIME(0,0,1)}
{BRANCH LOOPA}

(bs)Ä(quit)
O Ö(LET START, @now)

LOOPO {LOOK IN_CHAR} {IF IN_CHAR>""}{quit} {IF @NOW<STAT!*PIME(0,0,1)}{BRANCH LOOPO} {bs}O{quit}

{IF @NOW<START+@TIME(0,0,1)}{BRANCH LOOPU}
{bs}U{quit}

{bs}equit}

START 31783.60

typing a character within the 1-second dePC MAGAZINE APRIL 28.1987

PC MAGAZINE APRIL 28.1987

IN CHAR

■ SPREADSHEET CLINIC

cludes IN_CHAR and START. To get the international characters into the macros to begin with, follow the regular Lotus compose sequences.

> Fred Röösli Wheat Ridge, Colorado

I hud never seen the LOOK keyword in uction before. While I studied the example on page 194 of the 1-2-3 munual, I couldn't think of a useful upplication. Hats off to Mr. Röösli for an elegunt, useful one I would change only one thing. In the \E

macro, hitting the Spacebar does get you an ê, but it also moves the cursor one spuce (no surprise). This is inconvenient for two reasons. Many words end with an é, so a space is what often logically follows the default character (the one you get if you keep typing). You have to type something to keep that é on the screen, and what if the natural thing to type is a space? You end up with a circumflex instead. Also, I can think of na French word that ends in ê. so it does no good to automatically put a space after it.

The simple solution is to reverse the positions of ê and é in the mucro. The more amusing solution is to get rid of that space altogether. I tried putting u {bs} into the third line of the macro just before {quit}, but that failed completely. The character that is reud into IN_CHAR is saved in a buffer and is executed after the macro ends. Thus, an additional (bs) wines out the è and leaves you with nothing.

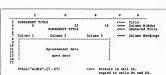
The solution is to use a key that is neither a character nar a space, but one that the macro will recognize, {del} or {graph} or {abs} will work fine. If you change the third line of the macro to

(If IN CHAR="{abs}"}{bs}equit}

and hit F4 before the 1-second delay, you'll get a circumflex. Hitting the absolute key doesn't make sense at this point so you get a beep, but the macro recognizes the keystroke and branches correctly.

CENTERING TEXT

In 1-2-3 there is no easy way to center a string of text within a spreadsheet. The usual procedure is to subtract the number of characters in the string from the total width of the printout, divide this difference



SREPEAT(SCHAR(31),((SSUM(C4..E4)-SLENGTH(C3))/2))&C3 cem Formule
 in cell C5

Alternete formula to replece #SUM(C4.,E4) in formula above: @CELL("width",C7..C7)+@CELL("width",D7..D7)+@CELL("width",E7..E7)

by two, and print the string that many spaces from the left margin, Release 2.0 of 1-2-3 provides a way to do this even if each column in your spreadsheet is a different

Figure 2: A method for centering text within the spreadsheet.

width Figure 2 shows a spreadsheet of only three columns: C, D, and E. I have centered the title, in cell D5, using a two-step process. First, I put the (a cell("width") formula in cells C4 through E4 to count the widths of the columns used in the spreadsheet. Then I used the long formula shown below it in the figure to center the title according to the method described above. Since the formula works by adding blanks to the text of the title, the formula itself is actually in C5, but the title spills over into the next column and seems to be in D5. The actual text of the title is in cell C3.

which is referenced twice in the formula in cell C5 When I print the worksheet, line 5 will be the first row of the print range and will contain a centered title. You can use the same technique to copy any number of different, centered titles to the top of a spreadsheet.

> Richard Bellin Washington, D.C.

The centering formula in cell C5 works exactly as it should, though I might use it a little differently. If I didn't need to know the widths of the different columns in my spreadsheet, I'd skip the first step by getting rid of the formulas in cells C4 to E4. I would put that information into the centering formula by replacing (a sum(C4..E4) with the ulternative formula that I have added to Figure 2.

If I wanted to display column-width information, for strictly aesthetic reasons I would put it at the bottam of the spreadsheet rather than ut the top. Then I would have a cell that totaled the column-width numbers, so I could tell at a glance how muny characters wide my spreadsheet was. That way I'd know, without wasting time und puper, whether the printout

RUNNING 1-2-3 FROM A RAMDISK

would fit on my printer.

A submission in Spreadsheet Clinic of November 25, 1986 (Volume 5 Number 20), highlights the advantages of running SuperCalc from a RAMdisk. In your comments, you note that this can't be done with Lotus products because of their copyprotection schemes. It's true that the Softguard protection scheme involves hidden and uncopyable files, which can't be put into RAMdrive

There are, however, at least two copy programs-CopyWrite and CopyII PC—that let you replace the original Lotus 123 COM file with an executable 123.EXE file that runs without the hidden Softguard files. As long as you also have all the other necessary program files (such as .CMP and .SET) on the RAMdisk, you can run 123.EXE entirely in RAM, thereby speeding up disk access.

Matthew Shapiro Baltimore, Maryland

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■ SPREADSHEET CLINIC

This is true. It's also legal. Fortunately, unless you are printing graphs a lot or using the help screens all the time, 1-2-3 doesn't do much disk access.

Another way to get some older copyprotected programs onto a RAMdisk is to use a disk utility to find the protection scheme files, unhide them, and put them on the RAMdisk, too. This won't work, however, for the recent versions of Softguard that let you run 1-2-3 from a hard disk without a key disk. That's because part of the installation process includes an assessment of the characteristics of your hard disk. If the program finds that it is being run somewhere else-on a RAMdisk, for example-it won't load.

HIDING SPREADSHEET FILES

In the October 14, 1986, Spreadsheet Clinic (Volume 5 Number 17), there was an interesting submission called "Poor Man's Worksheet Protection." [This discussed a

simple way to keep people out of your 1-2-3 files. If you use /wey or /qy as the autoexecuting macro, the spreadsheet won't stay on the screen. The trick to getting into the spreadsheet yourself is to hit Ctrl-Break just as the macro executes. Or, you can use /File Combine to read the boobytrapped spreadsheet into one that's not-preferably, into one that contains your settings and ranges, since /File Combine won't automatically retrive

Another simple way to protect or hide files is to change their extensions. Lotus products display only those files with .WKS, .WRI, .PRN, and other legal extensions. Even in DOS, if a snoop is looking for worksheet files, he might overlook anything that doesn't have a Lotus extension. When you want to use the files yourself, just rename them with the proper extension so that 1-2-3 or Symphony can recognize them.

This isn't perfect protection, but it will stop a lot of people. Also, it's a good way to keep backup files that won't be overwritten every time you need to make a change.

Claude Hurtt Center Point, Alabama

Not perfect, but not bad, either. One especially nice thing is that this is a trick that works with any program, spreadsheet or otherwise, that recognizes data files by their extensions.

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CONNECTIVITY CLINIC



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ing an IBM PC AT as a server. Lately, it seems the response time has increased. We are doing the same jobs, but things seem to take longer. Any ideas?

Yes, two: disk and cables. First, carefully clean up the hard disk on the server. Working from a network workstation, erase all unused files on the server. Back up the hard disk on tape, floppy disks, or another AT using a file-by-file backup (not "disk image"). Shut down the network, bring the server up only under DOS, and run CHKDSK. It is never a good idea to run CHKDSK over an operational network (many network programs block the command). After a lot of use, files often become fragmented and may be spread all over the hard disk. Network operation puts a lot of stress on the disk, and if the heads have to fly all over to read a file, the inefficiency shows. If you really want to do the iob right, make sure you have a good backup and then run the AT diagnostics on the hard disk. Restore the files to the disk on a file-by-file basis.

Second, check the cables. The 3Com software and Ethernet protocols are designed to overcome lost and garbled messages and transmission collisions. But this effort can take time. Make sur that he cables are still good conductors and not burdens the network is trying to overcome. Immediately check the grounded terminator on one (and only one) end of the cable to make sure it is still grounded. Then go through and disconners and recompet to: eral times. These things oxidize. They are silver-plated and can tarnish. There can be oxides and molds growing in the warm, dark connections that conduct poorly. Check your cabling carefully. If no other changes were made in the system, then one or both of these actions should bring the operation back up to stuff.

DATAINDIGESTION

Our long-distance phone lines are getting wore. We transmit sales and inventory data in ASCII files from our restaurants in North and South Carolina and Georgia to our office in Charleston every night. The system uses PCs, US Roboties 1,200-bps-mockens, and dated phone calls on MCI. Lately we get a lot of gardles that take another phone call and two people to clear up. MCI and the local telephone consenses asy their lines are clear. Is there a way to move data that doesn't gardle?

■ To move data without garbling it, consider an electronic courier: Lotus Express uses MCI Mail to transfer files with error checking. You have four alternatives: overnight courier, an electronic courier, improving your long-distance service, and using error-detection software. Why not put the data on a floppy disk and give it to Federal Express or some other overnight courier? They don't garble bits. Why go high-tech if high-touch will work?

Consider an electronic courier: Lotus has a new product called Lotus Express that automatically and invisibly uses MCI Mail to transfer document or spreadsheet files complete with error checking. Express operates in the background mode. leaving the computer available for other tasks. It steals RAM, but in your application you could load it into a machine at the end of each day and leave it running all night. Express costs \$100 and includes the initial subscription to MCI Mail (you will need one for each location). If there are MCI Mail hubs or Tymnet access ports in the local dialing range of your restaurants, the cost is very low. (Lotus Development Corp., Cambridge, Mass., (617) 577-8500. MCI Mail, Washington, D.C., (800) MCI-2255.1

Even if you use overnight or electronic couriers, you should still clean up your telephone problems. You can have more than one long-distance telephone company, so open accounts with other carriers (there may be a small charge to establish an account) and see what the "garble factor" of each one is.

Don't make a decision on the long-distance carrier to be used for all your restaurants based on a sample of one location, and don't buy long-distance services on



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price alone. Each locution may get a different quality of long-distance service from the same company. The price of a longdistance service probably has no relationship to its quality. Be ready to change if the lions program that does error detection

quality of a carrier's service in a particular location fulls off.

If you trunsfer the datu over long-distance culls, you should use a communicaand retransmission. Many of the major programs in the market-Crosstalk XVI. Relay, Hyper Access, und others-can transfer your files automatically using error detection and correction. My favorite progrum designed for just this job is Transporter. It is very easy to use and does every file tronsfer with error detection. However, none of these progrums will work efficiently over noisy phone lines. Clear up the phone lines, then try Transporter. (\$295, Microstuf, Roswell, Ga., (404) 998,3998



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CALLING ALL CARDS

Our city police department uses PCs networked with 3Com EtherLink cards and running Novell's NetWare for administrative services. Each precinct has between 3 and 12 workstations. Our one trouble spot is in a precinct station near the airport. The response time through that network varies greatly and sometimes the network just seems to hang up. We have exchanged every networking card, the entire network software, the server, all the cable, and lots of hardware in the PCs. My boss says it's the radios from all the planes. Could that be?

NetWare and EtherLink usually either work well or not ot oll. Intermittent problems are not typical. The first things I would suspect from the symptoms are a bad cable connector or problems with the hard disk drive in the network server. But. since you say you changed those pieces out of the network, I go along with at least a

part of what your boss says. The radios used in air traffic control are too low in power to interfere with your local network. Errant signals from nearby aircraft-control radios would probably interfere with police radios as well. However, some of the navigational aids used around an airport have peak pulse power measured in megawatts. It is possible that the network cuble is picking up pulses from surveillance radars or weather radars as their antennas sweep by. Radars aren't always on, can use different transmitters, and may use different antenna polarizations. All these factors could affect how much RF the network picks up at any one

RF pulses can deafen the receivers on

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the EtherLink cards. I have seen similar problems in IBM 3270 coaxial cable installations near a radar.

Check to see that one of the EtherLink terminating resistors is properly connected to a good electrical ground. The chassis of the computer might not be good enough to do the trick. Take the usual precautions. such as making sure that all covers and access plates are screwed on tightly. Run a wire from the nearest cold water pipe to some point on the network and attach it to the outer shield of the cable. Also, be sure to check for sources of pickup such as printer cables. Everything in a high-RF area must be fully shielded. A printer switch box that didn't properly ground the unselected printer was found to be the culprit in one installation

Since you have several networks serving important public functions. I suggest that the department budget for a network analysis system like Excelan's LANalyzer. This is a powerful tool for troubleshooting. debugging, and managing local area networks. It is available either as a separate board and software system that you install in a desktop PC or as a LANalyzer System Package installed in a Compaq for porta-

The LANalyzer software produces statistics for up to 200 network stations concurrently. It can describe network utilization, packet and error counts, packet rates and size distribution, and other factors, The board and software cost \$9,500, but with the investment in network hardware and software you already have, buying a maintenance system like the LANalyzer makes a lot of sense. Specify the model for "thin" Ethernet, (Excelan, San Jose, Calif., (408) 434-2300.)

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BATTING OUT BOXES

While experimenting with the .BAT file routines in PC Lab Notes (Volume 5 Number 6). I wondered if I could create something more interesting on-screen than just text menus. As a WordPerfect user, the obvious approach was to use WordPerfect's line-drawing function to create the displays, then try saving them as DOS text files. My . BAT files then call up the menus using the TYPE command, as suggested by Tom Sheldon.

As Figure 1 graphically shows, the trick works. I've found I can draw boxes or use any alternate character available within WordPerfect. My menus are much more readable this way, and creating them is a lot of fun.

John T. Jensen Oren, Utah

The key here is to make sure you save the files as DOS text files, using the Text Out command (Ctrl-F5, 1). If you try to TYPE a file in DOS that's been saved in Word-Perfect format, you will find mostly garbage on your screen.

Readers should also be aware that this trick is by no means confined to WordPerfect. You can create this kind of menu with any text editor that can use the PC's highorder character set and can produce straight ASCII files. This eliminates programs like WordStar that can't use the high-order character set. But it includes programs like XyWrite. One admitted advantage with WordPerfect, however, is the line-drawing feature. With programs like XyWrite, you would have to draw a box

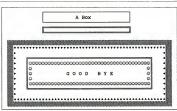


Figure 1: WordPerfect's line-drawing facility makes it easy to produce graphic designs such as these

keystroke by keystroke. WordPerfect lets you "paint" the box with ease, using the arrow keys .- M. David Stone

DOUBLESCREEN

In many applications, while it's essential to scan the database horizontally (i.e., one record per line), the narrow 80-character screen width too severely limits what you can see. 2SCREEN.PRG, shown in Figure 2, lets the user pan left and right, doubling the display width.

Of course, dBASE's BROWSE lets you pan, as well. But BROWSE can be too powerful, since it allows the user to edit and append to his heart's content-all completely outside the programmer's control. Suddenly all kinds of things go awry. You start to get urgent phone calls.

Besides protecting the data's integrity, 2SCREEN offers other benefits. For example, BROWSE automatically clears the screen upon exiting, whereas the user may want very much to retain the last display. Furthermore, BROWSE takes over the whole screen, while 2SCREEN gives you the top five and bottom two lines to display your client's name, program name, time, record number, etc., and also to customize the field headings. I've used the lower lines as a menu area, and one could easily add other choices like GOTO and FIND

To demonstrate this subroutine, I wrote it as a standalone program, using a sample database called 2SCREEN.DBF that you'll have to create to test the program







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Imagine using a word processing and drawing program that lets you integrate charts and pictures that you 'paint or 'clip' into your text. Well, if you use an IBM PC or Clone, now you can have graphically dramatic documents, from business or personal letters, to proposals, to organization charts, even with a daisy wheal printer.

By Drew Keols It's easy, It's impressive. And, now your thoughts can be powerfully illuatrated in both words and graphics.

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You'll produce visually powerful technical papers and manuals with drawings and charts, and dramatic marketing reporta with graphs, You'll produce sales proposals with panache.

And since there's no complicated training needed (if you can run a word processor, you can run Savtek), you'll make grest impressions, fast. Anyway, once you've created the writ-

ten part of your report, using Saytek's sophisticated automatic word processing festures, you're ready to add pictures, charts and graphs. Just select from the over 100 sup-

plied changeable pictures or draw your own, using the automated ICON based drawing program.

Later, you'll learn much more about

the sophisticated drawing program that lets you draw, paint, fill, expand, reduce, copy, and move your pictures

And, you'll form squares, circles and triangles automatically. Anyone can draw with it because it's totally sutomated and uses arrow keys and doesn't require

a mouse. But, read on. Once you've selected a picture, the computer will produce an automatically sized box representing it. Just position

the box wherever you want the picture to be in the text Like magic, the actual picture will sppear and the text will sutomatically

reformst itself around it. And, speaking of reformatting, this program will automatically make page-

breaks and recalculate each page as you write or edit. If you make an addition to page 1 of a 10 page report, the effect will ripple through all 10 pages. So, whatever length you've chosen

for each page (including headers, footera and sutomstic page numbering), will sutomatically be preserved. You'll particularly like the cut and paste

features of this word processing program which allow you to copy, move or delete sections of your text Of course, you'll heve automatic Word-

vrap, Hidden Hyphenation, Justified Smooth Right or Ragged Right text. Plus, you'll have Find, Replace and Search. And look how you can format your document. There are 5 page templates called rulers which allow you to sutomatically set up your page.

You can select any right and/or left margins, your tabs, one, two or three line spacing, and the number of blank lines at the top and bottom of your page Each of the 5 rulers comes with different default settings. But, you can ad-

just and save them or change them and even use several at one time on a page HOW DO THE PRINTERS WORK? I use a daisy wheel printer because I

like my letters to look personal. I've always had to switch to a dot matrix printer for graphs and illustrations.

Unfortunately, | couldn't have my graph-

ics on the same page sa my text. Now, because this program can use the period on the daisy wheel to create all the charts and graphic symbols you see within this ad, I don't need to switch printers any more.

And while it doesn't create the graphics as fast as a dot matrix, the quality is superb. Now my graphics can be impresvely integrated into my text.

Note: Every single sample page sho in this ad, was printed out on my EXP 400 Silver Reed daisy wheel printer. Note: This program does not produce

two column news letters in a single action. Simply create a double length column and cut it when you have it printed. No matter what printer you use, deisy

wheel, dot metrix (with or without nest letter quelity printing) or ink jet (color or single color), you'll have powerful looking documents to really present your idess in the most professional menner. DESKTOP PUBLISHING

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THE 1000 WORD PICTURE

First a confession. I can't draw. That's why you don't see drawings in DAK's cstalogs. But I've been amszed at how creative I can be with this paint program.

It's essy. You do everything with the arrow keys and the return key. By using the arrow keys you can draw in any direction with a choice of 12 brush shapes. There's an erase function to eliminate

rything you don't like. And here's my favorite function. UNDO is a function that works throughout this program,

... Publishing Continued It aimply removes the last thing you did. So, no matter what you do wrong, you're a button away from removing it. If you don't want a solid line, just spray an area. It's like using a spray can. Let's ssy you want to connect two oints with a straight line. Use the Angle Line. It produces a computer generated straight line between any two points.

What if you want a circle? Just touch the return key. Then use the disgonal arrow key to enlarge or reduce the circle. If you use the up/down or right/left arrowa, you'll get an ellipse.

In the same way you can create squa rectangles or triangles. And you'll be amazed how many things, from houses to technical drawings, are made up of squares, rectangles, circles and triangles. But, that's not sll. You can choose sny of 32 background patterns to fill in er closed areas or broad lines. And if 32 isn't enough, you can design your own,

You can copy or move a picture or even part of a picture right on the screen. So, draw it once and copy it or move it. But, here's my favorite. You can enlarge or reduce any picture or part of a

picture right on the acreen. So you can change its size equally, or you can stretch it out or make it tall and thin. Wowl There are 12 included font/sizes. So

you can have large or small type in your choice of styles within a picture or integrated with your text. And, each of the 12 font/sizes can be

shown on the screen and printed normally, in bold, in italic, in outline, or in shadow. Plus, you can write normally

across the page, up the page, down the page or upaide down. Finally, you can zoom into any small section of the screen and edit your pictures, pixel by pixel. With this kind of

You can operate this Paint program independently. Or, you can access any

print directly from the Paint Program. Or, for everything previously described, simply access your pictures, captions, graphs or charts through the desktop publishing section.

This program is incredibly powerful, yet you'll be comfortable using it within

just a few hours. Every picture in this ad was created with this program. And, you haven't even seen the tip of the iceberg of its capabil-

ities. For example, if you have a picture on the screen, you can bring a second

picture up and join them together.

WHO CAN USE THE SYSTEM

All you need is an IBM PC, AT, XT or 100% compatible with standard IBM CGA or EGA graphics capability. It must have at least 256K, and either two floppy disk

drives or one floppy and a hard disk. Below is a list of some of the dot matrix, ink jet and daisy wheel printers that have been tested with this program. If your printer is compatible with any of

these printers, it should work too. Special Note: Most daisy wheel printers are Diablo 620/630 compatible, so they will work with this program

Special Note: With a color printer you Special Note: With a color printer can print 3 colors plus black text.

La SOL 0.01 SOC 1400 Mod With a color printer Soc Members Bendard 2250 Finish a coloration (1.00 SOL 0.01 SOC 1400 Mod With a coloration (1.00 SOL 0.01 SOC 1400 Mod With a coloration printer sillar display a coloration (1.00 Soc 1400 Mod With a coloration (1.00 Soc 1400 Mod With a coloration printer sillar display soc 1400 Mod With a coloration (1.00 Soc 1400 Mod With FINAL FACTS

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POWER USER

```
*** 2SCREEN PRG
                   Pans 2 screens.
SET TALK OFF
USE 2screen
* (Sample .dbf for testing)
PRIV client, sp, headl, head2, fldl, fld2
yrclient=[ABC COMPANY - PURCHASER FILE]
Sp=SPAC(2)
headl=' REC# COMPANY NAME----;
        CONTACT NAME-----
        CONTACT TITLE----
head2=' REC# CO NAME (Abbrev)---- ';
     +'STREET ADDRESS----';
     + CTTY---- ST ZTP--
fldl='STR(RECN(),4)+sp+Co+sp+Name+sp+Titl'
fld2='STR(RECN(),4)+sp+SUBS(Co,1,20)+sp+';
+'Str+sp+City+" "+St+" "+Zip'
* you customize above 6 variables
PRIV scr,xk,xkey1,xkey2,crec,ans
ser="1"
xk=' 3, 5, 13, 18, 24, 27, 88,181,128'
xkeyl=' 2, 4,'+xk
xkey2=' 19, 26,'+xk
CLEA
SET ESCAPE OFF
@ 1,8 TO 3,79 DOUBLE
@ 2.(48-LEN(vrclient)/2) SAY vrclient
DO WHIL .T.
  9 4,8 CLEA
   4,8 SAY head&scr
  @ 5,8 TO 5,79
  crec=RECN()
  cfld=fld&scr
  DISP OFF NEXT 15 &cfld
  IF . NOT. EOF()
    SKIP
  ENDI
  @ 23,8 TO 23,79
  @ 24,4 SAY IIF(EOF(), "END OF FILE",;
```

@ 24,55 SAY "E<x>it or <ESC>ape Figure 2: This dBASE subroutine lets you scan up, down, left, and right.

+" Left", CHR(27)+" Right")+" Screen"

PqUp @ 24,32 SAY IIF(scr="1",CHR(26);

Field	Field Name	Type	Width
ı	NAME	Char	20
2	TITL	Char	22
3	CO	Char	25
4	STR	Char	25
5	CITY	Char	14
6	ST	Char	2
7	ZIP	Char	5

"MORE: PqDn")+"

tine, see the *Comments at the top and bottom of the program. The database will already be set up, so remove the USE commands. Also, you will have to rewrite the top set of variables (those listed in the first PRIVATE statement) to fit the fields in your database. Except for rewriting the lines that contain IIF or INKEY(). 2SCREEN runs in any version of dBASE. Dung Quoc Vu

Anaheim, California

```
ans=" g=
  DO WHIL . NOT. ans$xkey&scr
    ans=STR(INKE(),3)
  ENDDO
  DO CASE
  CASE ans$' 2, 4, 19, 26'
scr=IIF(ans$" 2, 4","2","1")
    GOTO crec'
  CASE ans$' 5, 18'
    GOTO crec
    temp=0
    DO WHIL temp<15 .AND..NOT.BOF()
      SKIP -1
      temp=temp+1
    ENDDO
  CASE ans$' 27, 88,128'.OR.EOF()
    EXIT
  ENDCASE
ENDD
USE
SET ESCAPE ON
SET TALK ON
* Above 3 lines for testing only
@ 23.0 CLEA
RETU
```

(Figure 2 ends)

E's BROWSE command is versatile sowerful-there's nothing like it for active use. But BROWSE was never gived as a read-only displaying tool. ightly knit application, Mr. Vu is abely right about there being a real dann letting users change data outside of ram control. Fools rush in where anshould be led

 Vu's coding is both concise (e.g., space-saving use of the &scr macro IIF statements) and flexible (you can with <Esc>, "x", or "X"). If you d to see still more data for each record.

you could easily convert 2SCREEN.PRG into 3SCREEN PRG.

Now let's go full circle, from dBASE to Clipper, and from read-only scanning to direct editing. Clipper itself does not support the BROWSE interactive commands, and sometimes you need all the power of BROWSE's scanning, panning, editing, appending, and file-positioning capabilities. Happily, however, Personal Programming has produced an excellent emulation of BROWSE, details of which are shown in the accompanying Fact File. -Brad Stark





Browse, Version 2.00 Personal Programming P.O. Box 1241 Tualatin, OR 97062 (503) 692-0749 List Price: \$15 Requires: 256K RAM.

one disk drive as a standalone utility. Some dBASE programming knowledge and more RAM is required when compiling Browse as port of a larger applica-

In Short: Clipper-compiled applications can call Browse as a subroutine with little or no rewriting. It supports all dBASE III BROWSE keypad functions and updates active indexes. Though implemented a little differently than in dBASE, GOTO, FIND, EDIT, and APPEND are available via function keys. Commented source code and documentation are included, so it is fairly easy to modify for each application-a great timesaver. Though copyrighted, Personal Programming does permit programmers to customize and compile Browse into commercial "run-time" programs. Not copy protected. CRCLE 623 ON READER SERVICE CARD



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ENVELOPES WITH TRACTORS

On most printers with a tractor feed, you have to remove the paper every time you want to print an envelope. There's an easier way. First, slide the bottom edge of the envelope between the printhead and the paper and work the envelope backwards, under the platen, through the paper feed path. Then use a Post-it note to "stick" the envelope in position. Put half of the sticky portion on the envelope and half on the paper, being careful not to cover the return address area. Finally, line up the envelope and print.

W.C. Ginn Albuquerque, New Mexico

A good idea, but unfortunately it just doesn't work with all printers: in some cases it's impossible to slide the envelope backwards into the paper path. With other printers, the top corners of the envelope will hit the tractor feed doors as the paper advances, dislodging the envelope from the paper, Post-it or no. In such a situation, however, you may be able to engage the friction feed to hold the envelopes with the tractor doors open .- M. David Stone

SPELLING BY THE SAURUS

The Microsoft Word Spell program can't find the right spelling of a word while you are writing or editing. With Word, Version 3.1, however, you can use the Thesaurus facility to spot-check a word. If it's spelled right, you get a list of synonyms and can continue by hitting Escape. If the word is not in the Thesaurus, you get a list of near misses; if the correct spelling is listed, simply copy it into your document. Even with a floppy-based system, this is quicker than using a dictionary, and you don't use up valuable RAM with an on-line spelling

David Ross

A neat trick, and one that will work with the Word Finder Thesaurus program with nearly any word processor. -M. David Stone

MISSING PERSONS REPORT

dBASE III and Clipper users should be alerted to a potentially serious bug that occurs when INDEX UNIQUE encounters records marked for deletion. If you depend on precise accuracy from this command. beware. Here's a simplified example, in which records marked for deletion are indicated by an asterisk:

- Record# Name
 - 1 Jones 2" Iones
 - 3* Psmith
 - 4 Psmith

If you INDEX UNIQUE with SET DE-LETE OFF, the software will see the first Winterville, Georgia | Psmith it finds but will show it marked for

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deletion (where it could be lost if you | dBASE's TOTAL ON capability instead. PACK later).

1 Iones 3* Psmith

If you INDEX UNIQUE on this field with SET DELETE ON, the software will note that the first Psmith is deleted and ignore the rest of that key! All you'll have

1 Jones

A major vendor like Ashton-Tate should make its users aware of the situation and not take the attitude, "You find the bug first, then we'll send you the fix." With a large database, identifying and fixing an error like this can be a nightmare. Antonio D. Wilkinson Dallas, Texas

Moral: You should always PACK your file before using INDEX UNIOUE, or use

Actually, INDEX UNIOUE sometimes fails in other ways too. Call it dBASE rou-

lette-a new game you can play on your own computer! I recently used INDE

A major vendor should not take the attitude.

"You find the bug, then we'll send you the fix."

UNIQ on a 9,000-record file and lost all the records between CO and GU plus all those below WH. Repeating the process three times produced the same gaps using a Compaq Portable 286, and again using an IBM PC AT. One might want to list a

key field from every 100th record to make sure you're playing with a full deck!

Ashton-Tate acknowledged both the problem I found and Mr. Wilkinson's. Better, it has fixed them in the more recent non-copy-protected version of dBASE III Plus. The company offered to send the new software update for \$45-about \$45 too high for correcting a potentially disastrous flaw. I eventually got the update for free. -Brad Stark

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User-to-user



Adding fast, full-screen borders, an even better ERRORLEVEL routine, a technique for blanking compiled windows, and an 8087 coprocessor detector.

ULTIMATE ERRORLEVEL ROUTINE
The YESNO script in Figure 1 improves
the standard ERRORLEVEL batch file
branching program five ways:

branching program five with a propriate and lowercase responses and then makes the appropriate conversions. If a user enters a key other than Y. y. N. or n. the program beeps and the cursor remains where it is, if the user presses Ctrl-Break or Ctrl-C, the program stores and exist normally without changing the current ERRORLEVEL setting. The program prints a prompt on screen, so the batch file doesn't have to. In addition, it makes it extremely simple for programmers to texturely simple for programmers to the

the on-screen prompt.

Incidentally, DEBUG script files should really end with a .DEB extension rather than .SCR, since .SCR is widely used by graphics programs to designate screen files and screen domps.

Adam Baruch Kiriat Haim, Israel

If you want to charge the message from 'Enter Year ON'.' make the badage in the last line (starting with the di). Then adapts the hex unther 44 at the end of the script between rex and we accordingle, I you make the message bigger, increase the 44-If you make its smaller, aftercase the 44-If you make its smaller, after crease the 44-If you make its smaller, and a decimal ane, so that If your new prompt is for Character's shorter, the new hex number is 5/1 not 38-And remember to print if final Sec.

A sample batch file to exploit this program would be:

```
echo off
yssno
if errorlevel == 1 goto yss
echo -- you amid no
goto end
:yss
echo -- you maid yes
```

Changing the extension on scripts to .DEB does make some sense, except that these script files aren't really meant to last

longer than it takes to create a .COM file with no typos. You don't need any extension unless you plan to archive them. Around the office we create temporary files with names like TEMP, anyway.

FAST BORDERS

Lots of readers wrote in to tell us how much they liked the two programs by Alan

```
n yasno.com
mov dx,132
nov sh,9
                       ;move offset of atring to DX
                       joutput character string
 int 21
                       ido it
nov sh, e
                       cheracter output without echo
                       /do it
/tu+rn response to upper case
/put AX onto etack
/compars reaponse to "N"
/if N jump to N strorlevel setter
/compars reaponse to "Y"
 and al,df
push sx
cmp sl,4e
 cmp al,59
                       /compars reaponse to "Y"
/if Y jump to Y errorlevel setter
 iz 123
 nov dl,7
                       /otherwise set up besp with CHR$(7)
nov sh,2
                       ido it
DOD AX
                       remove AX from stack
                       rismove AX from Stack

jand go back to beginning

jact strorlevel to 0 = N

jand jump around Y

jast strorlevel to 1 = Y

jrsmove AX from stack
jnp 107
mov bl.0
jnp 125
 mov bl.1
pop sx
nov dl,sl
                       /gst resdy to displsy response
/direct console I/O (displsy)
mov ah,6
int 21
nov sl,bl
                       move strorleysl to AL
nov ah,4c /terminets
int 21 /do it
db "Enter Yes or No: S"
                       /terminate with return code
44
```

Figure 1: FESNO script to create YESNO.COM. Type this in using a pure-ASCII word processor or the DOS COPY COM command. Be sure to leave a blank line before rex and his the Extre Key whe end of each line. especially the lass one. Then put in and a copy of DEBUG.COM (Persina 2.0 or later) on your disk and type DEBUG<YESNO.A Y (ory) returns an ERRORLEVEL of 1, anN torn Jun ERRORLEVEL of 0.





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■ USER-TO-USER

Rouse and Larry Zimmerman in Volume 5 Number 17. Both programs made it easy to turn text files into small .COM files that displayed almost instantly. This technique let users create fast menus, help screens, readme files, etc.

readmentes, etc.
Interestingly, several readers mentioned the difficulty in putting borders
around the entire screen while in BASIC.
BASIC normally scrolls the screen up
when it prints a character in the last column of the 24th or 25th row.

There are several ways around this. Microsoft's QuickBASIC 2.0 lets you print in the lower-right-hand corner of the

```
186 ' poker.bas

118 DF ESC

118 DF ESC

118 DF ESC

128 FORE 44 TO 5 STEP -5

148 FILES

148 FILES

149 FORE 4, 95

158 FORE 4, 95

158 FORE 31, A

158 FORE
```

298 NEXT 388 PORE 92,25 Figure 2: Sample screen-size-changing program. screen. Or you can lengthen the screen with a POKE to that the 25th line isn't really the lower-right-hand corner, If you to 17th line isn't really the lower-right-hand corner, If you to 17th line remember to use another POKE command to bring the screen back to normal size, or BASIC will start printing things out below the 25th line, and you won't see them. To lengthen the screen, simply type

DEF SEG:POKE 92,27

To bring the screen back to normal, type DEF_SEG: POKE_92.24

POKE 41,x adjusts the right edge of the screen, POKE 91,x the top, and POKE 92,x the bottom (where x is the value you want to POKE in). The sample program in Figure 2 demonstrates the effect.

Finally, you can POKE values directly into the screen memory and prevent scrolling. If you're using a mono monitor, issue a DEF SEG = 4/H8000. Instruction, such a DEF SEG = 4/H8000. Instruction yas do a POKE 5/88. As past samething in you do a POKE 5/88. As past samething in you do a POKE 5/88. As past samething in you do a POKE 5/88. As past samething in you do a POKE 5/88. As past samething in you want to set the dutribuse, POKE 4 value into the following byte. To color the add of the 24th line, do a POKE 5/89%. A For the 8/th Colomn of the 25th line, it's POKE 5/99%. This will put a red, white.

Figure 3: Program that fills the screen with random text strings, then POKEs a border into memory, BSAVEs the image (as a file called TEST), and then reloads the image complete with border.

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HISER-TO-HISER

and blue "US" in the lower-right-hand corner of a color screen:

10 DEF SEG-&HB800 20 POKE 3838.85 3Ø POKE 3839.23

40 POKE 3998.83 5Ø POKE 3999,71

The program in Figure 3 will fill the screen with random text strings, then POKE a border into memory. BSAVE the image (as a file called TEST), and then reload the image complete with border.

COMPILED WINDOWS

Edison Hsu's BASIC windowing technique in the April 16, 1985, issue (Volume 4 Number 8) works in interpretive but not compiled BASIC. This is because the string length location pointed to by VARPTR is 1 byte in interpretive BASIC, but 2 bytes long in compiled BASIC be-

```
' WINDOW, BAS -- for compiled BASICs only !!
118 * Original by Edison Hau; revised by Franceso Francescangeli
128 DEFINT I:FOR :=1 TO 24:PRINT STRING$(88, "*"); NEXT
138 LOCATE 12,25:PRINT " Bit any key to clear window "
149 WHILE INKEYS="NEEDD
```

148 WBILE INKEY=--IMENU
159 '*** parameters: lat row,last row,lst col,lsst col ***
158 CALL ILR(3,28,18,78);END
55885 '=== subroutine to clear the window ===
65918 SUB LIR(IP1,122,173,174) STATIC

55928 RESTORE: CLRS***
65938 '*** the first 7 (between 87 and CD) controls color ***
65949 DATA 55,6,88,8,6,89,8,8,18,87,7,CD,18,7,5D,CB
65958 TOR IT=1 TO 16:READ ILAS: CLRS*-CLRS*(CAR\$(VAL(*28**-ILA\$)); HEXT
65968 MIDS (CLRS,8,1)=CRR\$([P1); HIDS (CLRS,11,1); OURS(IP2)

and(cast,7;;|-and*(cpl),NiDe(cast,1);-and*(c

65140 * *** execute DATA program ***
65150 CALL ABSOLUTE (III) 65168 END SUB

Figure 4: Program to blank a window, for Microsoft BASIC compilers, Versious 2.0 and above. This will create a gray-on-black window; for a colored window change the first 7 (between B7 and CD) in line 65040.

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cause of the increased string length (32767) that the compiler supports. VARPTR+1 and VARPTR+2, which point to string address, must be changed in any compiled version to VARPTR+2 and VARPTR+3.

If you're using the compiler, it's also a good idea to take advantage of CALL AB-SOLUTE and supply the parameters. The WINDOW. BAS program (designed for Microsoft BASIC Compiler 2.0 or later) in Figure 4 demonstrates how fast such windowing works.

Calling the subroutine is very simple, using the format

CALL ILR(rl,r2,cl,c2)

where r1 and r2 are the first and last rows, and c1 and c2 are the first and the last columns of the window to be blanked. All four values must be decreased by 1, so if you want to blank from row 6 to row 24 and from column 10 to column 70, you Some compilers (for example, Turbo-87
 Pascal) support the

8087/80287 coprocessor but do not check to see if one is installed.

should substitute values 5, 23, 9, and 79. Francesco Francescangeli Istia, Italy

This does indeed work quickly. The initial 7 (between B7 and CD) in line 65040 sets the window color to gray on black; for a

colored window, substitute another value there. For instance, a 4E will change it to bright yellow on red.

8087 SNIFFE R

Some compilers (for example, Turbo-87 Pascal) support the 8087/80287 mathematics coprocessor but do not check to see if one is installed. If there is no coprocessor, the machine locks up and must be powered down in order to reboot.

CHK8087.COM is a short machinelanguage program that can be used in a batch program to check the existence or absence of an 8087 chip. It returns an exit code of 0 if a coprocessor is installed, and 2 if not installed, this can subsequently be checked by an IF ERRORLEVEL statement.

To create CHK8087.COM, type in the following CHK8087 script using a pure-ASCII word processor or the DOS COPY CON command. Then put it and DEBUG

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PRODUCTIVITY

■ USER-TO-USER

.COM (Version 2.0 or later) onto your disk and type DEBUG < CHK8087. Be sure to leave a blank line before rcx and hit the Enter key at the end of each line, especially the last one.

a int 11 and a1,2 xor a1,2

mov ah, 4c int 21

rcx a

n chk8#87.com

The program calls BIOS INT 11H to retrive the switch settings on the system board and then DOS function 4CH to exit with the appropriate code. DOS Version 2.0 or later is required, and the utility may not work on some non-IBM machines.

not work on some non-IBM machines.

The following batch program runs the program FASTPROG if a coprocessor is installed and runs SLOWPROG other-

wise: Echo off Chk8887

Chk8887 If ErrorLevel 2 goto RunSlow FastProq

GoTo ExitBat :RunSlow SlowProg

:ExitBat Echo Execution is complete

> Russell V. Lenth lowa City, Iowa

Any program that can use a math coprocessor but that locks up if none is found really should include a routine that checks for the presence or absence of the chip and acts accordingly. This is the next best thine.

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PC TUTOR



Modify your path on the fly with an undocumented batch file feature or C program; use an undocumented interrupt to avoid the need for a secondary copy of COMMAND.COM.

WIDENING THE PATH

I tend to create a lot of subdirectories on my hard disk, many of which contain executable files. I use the PATH command in an AUTOEXEC.BAT file so I can access these executable files from within other subdirectories.

However, my PATH is quite long, and if I want to add something to it I have to retype the whole thing with the new subdirectory at the end.

I program in C, but I've discovered that the compiler functions that modify the environment alter only the environment of the C program, not DOS's environment table. When the C program terminates, DOS's environment is still the same.

How can I get access to DOS's environment table?

Brian Murphy Ann Arbor, Michigan

The environment is maintained by COM-MAND. COM in an area of memory to which you don't have alrevie access. You can see the contents of the environment by executing the SET command with no parumeters. The environment always contains a variable celled COMSPEC, which indicates the disk and directory where COMMAND. COM is stored. If you've used the PATH and PROMPT commands, the the environment will contain those as well.

Whenever COMMAND. COM loads an executable program into memory, it makes a copy of the environment table for use by that program. The segment address of this copy is stored at offset 2Eh in the program's Program Segment Prefix (PSP).

```
#include catedo.h>
#include catedo.h>
#include catedo.h>
#include cyprocess.h>
#include cyprocess.h>
#include cyprocess.h>
#include cyprocess.h>
#include cyprocess.h>
#include cyprocess.h>
#include cyprocess.h
#inc
```

Figure 1: This ADDPATHC.C program appends a command line parameter onto your current path string and loads a secondary copy of COMMAND.COM.

```
N EDPATHA. COM
MOV
         BX.8368
                             ; Above top of program
         SP, BX
                             ; New stack pointer
ADD
         BX,+8F
         CL,84
         BX, CL
                             ; Convert BX to segment; Deallocate memory
         AH, 4A
INT
PUSH
         ES, [882C]
                             ; Points to environment
SUB
         DI, DI
SI, 816A
                             ; Points to "PATH"
CLD
ES:
CMP
         BYTE PTR [DI],00
                                      ; See if end
TT.
         8133
                             JZ TRANSFER
         CX,0005
YOM
                             ; 5 bytes ot compare
; Compare them
```

Figure 2: This DEBUG script creates EDPATHA.COM, a program that lets you edit your path string with the DOS editing keys. It uses the undocumented (and strange) interrupt 2Eh.

■ PC TUTOR

```
CKPSB
POP
Jz
        Ø133
                          1 JZ TRANSPER
SUB
        AL, AL
                          ; Search for next #
        CX,8888
MOV
REPNE
SCASE
        ØllB
                          JMP SEARCH
JMP
        BX, #16F
                          TRANSFER:
MOV
                          Number of chars already
MOV
        CL, 65
ES:
                          TRANSLOOP:
        AL,[DI]
HOV
                          ; Get byte
INC
        DI
                          ; Kick up pointer
OR
        8147
                          . J2 DONE
JZ
                          ; Kick up counter
INC
MOV
        [BX],AL
                          ; Save byte
TNC
        #138
                          JMP TRANSLOOP
JMP
MOV
        BYTE PTR [BX], OD
                                  ; CR at end
                          ; Save count
MOV
         [0169],CL
POP
        DX, 6168
MOV
                          ; Let user edit it
NOV
        AH. BA
INT
        SI,8168
MOV
                          : Fix it up
        AL,[SI+01]
MOV
INC
MOV
        [SI],AL
BYTE PTR [SI+#1],26
MOV
INT
        2 E
                           | Execute new path
                          : terminate
DB
         80,60
         "PATH="
DB
RCX
6F
```

(Figure 2 ends)

As you've noticed, any changes a program makes to this environment alter only the copy, not the original.

If you need only to add a new directory path to an existing path string, however, you can do so very easily with a one-line batch file. Let's call it ADDPATH BAT:

PATH=%PATH%; %1

You'd execute it by entering

ADDPATH C: \subdir where subdir is the subdirectory on drive C: that you want to add to your path string.

Don't go hunting through your DOS manual looking for the meaning of %PATH%. This batch file feature is not documented. (Interestingly enough, page 502 of the defunct MS-DOS Technical Reference Encyclopedia has a few words to say about it.

Here's how it works: In a batch file you can use an environment variable name as a replaceable parameter by surrounding

the name with percent signs. When COM-MAND.COM executes the batch file, it replaces %PATH% with the existing directry path from the environment. In ADDPATH.BAT, this is followed by a semicolon and the parameter on the ADD-PATH command line. When COMMAND-COM runs this batch file, then, if s as if a

whole new PATH command were being executed. The only real problem is that a bug in DOS 3.0 chokes on the %PATH% construction. ADDPATH won't work under DOS 3.0.

If you already have something programmed in Chat changes the program's copy of the environment, you can make that the current environment by having the program load a secondary copy of COM-MAND.COM then takerits the environment modified by the C program. The problem is that you end up with somewhat a less memory than before, because both the C program and the resident portion of the first COMMAND.COM are still sitting in memory not doing much of anything but taking up space. However, the advantages are that you can return to your original environment by executing an EXIT on the DOS command level.

Figure 1 shows a C program called ADDPATHC that does this. (The C at the end of "ADDPATHC" is just to distinguish the name from the batch file ADD-

■ Don't go hunting through your DOS

manual for the meaning of %PATH%. This batch

file feature is not documented.

PATH shown above, 3 The command syntax is the same as for ADDPATH. ADDPATHC has been compiled under ficrosoft C-400, other compilers may require some changes or may lack the necessary functions. You can significantly reduce the amount of memory that ADDPATHC loads these sup by using the (PCPARMAMALIOC parameter on LINK. Not that after ADDPATHC loads the COMMAND.COM, the environment will INFO". Microsoft C plus this string that the environment whenever it spowns a new process.

In theory, an ADDPATHB.BAS program that works the same way as the C program is also possible. Here's one written for QuickBASIC 2.0:

HYPATHS-ENVIRONS("PATH") + ";" + COMMANDS ENVIRON HYPATH\$ SHELL

(I did not use the BASICA interpreter for this job because it does not have any builtin procedure for accessing the command line parameter.)

Unfortunately, however, ADDPATHB almost always fails, returning an "Out of

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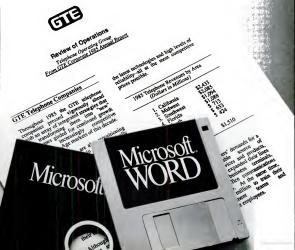
There were some features GTE hadn't thought to ask for Including an index and

table of contents generator. And an outline processor, built right in.

It all added up to a pretty long list, Which made for a short answer. Microsoft Word.

Microsoft Word is available for the IBM PC and compatibles and for the Apple Macintosi

word processing bright, very busy people a versatile tool, not



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main ()

```
static char editbuffer [88] = { "\x88\x88PATH=" };

stroat (editbuffer, getenv ("PATH"));
editbuffer [1] = etrlem (editbuffer + 2); /* count */
editbuffer [2] + editbuffer [1]] = 13; /* CR */
```

cqets (editbuffer);
editbuffer [8] = editbuffer [1]; /* count */
editbuffer [1] = '; /* blank */
editbuffer [2 + editbuffer [8]] = 13; /* CR */
INTER (editbuffer);

Figure 3: This EDPATHC program does the same thing as EDPATHA but is written in C for greater clarity.

memory" error. The QuickBASIC 2.0
manual warns about this, QuickBASIC seems to be working only with the environment area passed along to it by COM-MAND COM, while the Compiler moves the copy of the environment ADDPATHC created elsewhere and can allocate hove memory for it if necessary. Where is BA-SIC's dynamic memory allocation when you really need to the copy of the control of

Neither the batch file nor the C program approach is entirely satisfactory, however. The ADDPATH batch file only lets you add new paths onto your current path; you can't take them off again. The ADDPATHC program could be expanded to allow full editing of path strings, but you're stack with loading a new COM-MAND. COM every time you run.

It would be nice to have full editing control over a path string yet not have to load secondary copies of COMMAND.COM. Here's a way this can be done, using a batch file called EDPATHB.BAT (ED-PATHB stands for "EDit PATH with Batch file"):

ECHO PATH=%PATH% >NEWPATH.BAT EDLIN NEWPATH.BAT NEWPATH

The first line creates a file called NEW-PATH BAT had contains a PATH Command with your current path. (Once again, you can't use this under DOS 3.0.) The second line loads that into EDUM. Once in EDUM, you press I to edit the first (and only) line. You can then use the DOS editing keys (Right Arrow to recall characters, Del to delete them, Ins to go into insert mode, etc.) to change the path. Now

hit Enter, followed by E to end EDLIN.
EDPATHB then executes the NEWPATH
BAT batch file with your new path.

(If you don't like EDLIN, you can have this batch file load NEWPATH into the AS-CII text editor of your choice. Even among DOS jocks, EDLIN is one of the most neglected DOS programs. But it's great for

UNDOCUMENTED INTERRUPT There is yet another way to change COM-MAND.COM's environment from within a program without having to reload a secondary copy of COMMAND.COM. This method requires the use of the undocu-

small jobs like this.)

■ It would be nice to have full editing control over a path string yet not have to load a secondary copy of COMMAND .COM. This can be

done using a batch file.

mented and little-known (but strange) DOS interrupt 2Eh. This interrupt passes a command line addressed by DS:SI to COMMAND.COM. The command line must be formatted just like the unformatted parameter area of a PSP. That is, the first

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```
Interrupt 2Eh Call (for use with MS C programs)
        Public _INT2E
Segment Byte Public 'CODE'
_TEXT
        Assume CS: TEXT
                 7, 7
Stack
INT2E Proc
                 Near
        Push
                 BP
BP. SP
        Mov
        Push
                                            ; Save registers
        Push
                 DI
        Push
                 DS
        Mov
                 CS: [Stack], SP
                                            : Save stack pointer
        Mov
                 CS:[Stack + 2], 88
                 SI. SS: [BP + 4]
        Mov
                                            ; Get parameter
        Int
                                            ; Do Interrupt
        Mov
                 SS, CS:[Stack + 2]
                                            ; Get back stack
                 SP. CS: [Stack]
        Pop
                 DS
                                            : Get back register
                 DI
        Pop
         Pon
                 RP
 INT2E EndP
TEXT
        EndS
```

Figure 4: This INT2E.ASM assembly language subroutine is required for EDPATHC.

byte must be a count of characters, and the second and subsequent bytes must be a command line with parameters. The whole thing is terminated by a carriage return.

When this command line is passed to interrupt 2Eh, COMMAND,COM executes it. If the transient part of COM-MAND.COM is not present in memory, the resident part will reload it. However, it does not load a new copy of COM-MAND.COM into memory, as do ADD-PATHC and ADDPATHB.

Interrupt 2Eh is very strange. If it is called from a program executed from within a batch file, it will abort the batch file. If it's executed in a program run from a Runa-Program or Shell option in an application that has itself been executed from a batch file, it abarts the whole chain and will probably crash your system. Interrupt 2Eh is also difficult to use because it destroys the contents of all registers including the stack pointer. I've found no part of DOS that actually uses interrupt 2Eh, and I don't know why it exists.

Nevertheless, let's see how we can take advantage of it.

Figure 2 contains a DEBUG script that will create a program called ED- inner workings may not be quite clear. Avenue. New York, NY 10016.

PATHA.COM ("EDit PATH with Assembly program"). You can create the program in one step by going into DEBUG and typing in the lines shown (you don't need to type the semicolons or the comments that follow them). Alternatively, you can use an ASCII editor to create a script file (.SCR) consisting of the lines shown. Then use the redirect arrow to feed the script file into DEBUG thus:

DEBUG < EDPATHA.SCR

When you run EDPATHA, it searches the environment for a PATH and saves it in an area of memory following the characters "PATH=". EDPATHA then passes this string to DOS function call OAh, You can then use the DOS editing keys to edit it. For instance, if you want to add something onto the end, press F3. This recalls the whole line on-screen, and you just type the addition. You could also do inserts and deletes. When you're done, hit the carriage return, and EDPATHA will send the string to interrupt 2Eh. COMMAND.COM then executes the string like a regular PATH command

Because EDPATHA is in assembler, its

Figure 3 shows a C program called ED-PATHC.C ("EDit PATH with C") that does what the assembler program does but with a lot of help from the C built-in functions. (Again, Microsoft C 4.00 was used.) Because interrupt 2Eh destroys all the registers, including the stack pointer, the normal int86 function cannot be used. ED-PATHC instead requires an assembly language routine called INT2E.ASM. which is shown in Figure 4. You can create EDPATHC.EXE with the following commands:

MSC EDPATHC: MASM INTZE; LINK EDPATHC INTRE:

Of course, you can always take the brute force approach by having a program search around in memory for COM-MAND.COM's environment table and then go in there and modify it. This I would not recommend.

Heavy use of the environment, particularly from within an AUTOEXEC.BAT file, can cause it to become full. Under DOS 3.1 (and higher), you can expand the amount of memory COMMAND.COM reserves for the environment by putting the following line in your CONFIG.SYS file:

SHELL=COMMAND.COM /P /E:x

where x is a number between 10 and 62 indicating the number of paragraphs to allocate for the environment. The default is 10 paragraphs. Each paragraph is 16 bytes, so this allows you to set the environment to anything between 160 bytes and 992 bytes. This feature was not documented in DOS 3.1. In DOS 3.2 the /E parameter was documented, but it was also changed. You use exactly the same syntax, but now x directly specifies the number of bytes reserved for the environment, and its value may range from 160 to 32768.

Microsoft C 4.00 includes a program that will patch previous versions of COM-MAND.COM so that it can be used for larger environments.

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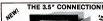
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COMMUNICATIONS ISSUE Connecting your personal computer to the world beyond your desk is one of the best ways to become a true participant in 'information age.' 'A telephone line, a modem, and a copy of Pc Magazine's special issue devoted to communications are all you'll need to get started down the road to on-line activity.

MOUNTAINS OF MODEMS First, the modems, in the blockbuster tradition, we have gathered over 80 modems from all price ranges and technical categories and subjected them to an exhaustive series of benchmark tests using PC Labs in now modem testing equipment. All the reviews of product's special features. We veal so provided an extensive glossary of communications terms and a comprehensive features table that will turn you into an instant modem expert.

ON-LINE DATABASES If you've ever considered linking up with an online database, take a look at Tom Badgett's introduction to 12 of today's most popular on-line databases, including The Source, CompuServe, Dow Jones News/Retrieval, BRS, GEnie, and Vu/ Text. These electronic almanacs offer their subscribers everything from current stock quotations and news bulletins to movie reviews and even on-line personal ads. Also included are reviews of three database search software packages that will help you maximize your on-line productivity and minimize your phone bills by helping you find the most direct route to the information you need.

ELECTRONIC MAIL Barbara Krasnoff reports on the ever-expanding world of electronic mail. It's the quick and easy way to send messages without the hassles of stamps or busy signals. Reviews include the three leading public e-mail services include MCI Mail, EasyLink, and AT&T Mail, as well as several of the more exclusive corporate e-mail services.

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